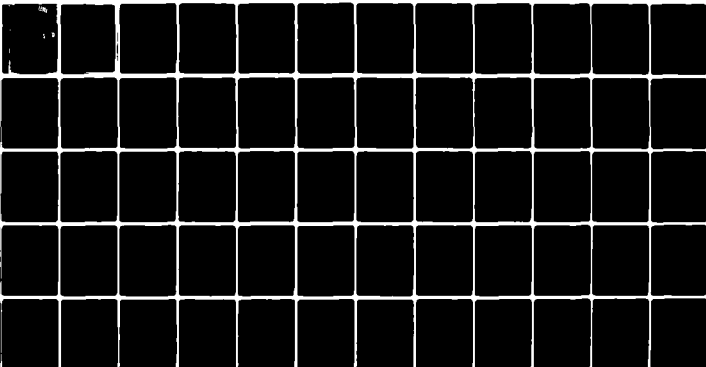


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GROUND-BASED MEASUREMENTS OF SOURCES IN THE AFGL INFRARED SKY S--ETC(U)
NOV 79 R J RUDY, T R BOSNELL, S P WILLNER F19628-76-C-0252
AFGL-TR-79-0172 NL

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report contains ground-based observations of 271 objects detected in the AFGL infrared sky survey, falling between 40 ^m and 60 ^m of each hour of right ascension and +60° and -30° of declination. Photometric magnitudes are presented for those sources which could be located from the ground and are compared to those reported by the			

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Air Force. Conclusions are drawn concerning the identification of AFGL sources with IRC sources. A rough classification is made of the catalogue objects within our area of the sky. Limits for completeness of the survey are approximately +1.0 mag at 4 μ m and -1.0 mag at 11 μ m. ↑

micrometers

CONTENTS

INTRODUCTION	4
OBSERVATIONAL PROCEDURE	5
OBSERVATIONS	9
A COMPARISON OF AFGL AND UCSD MAGNITUDES	20
IDENTIFICATION WITH IRC SOURCES	33
BREAKDOWN OF OBJECTS IN OUR ZONE	38
THE LIMITS OF THE AFGL SURVEY	39
UCSD PERSONNEL WHO PARTICIPATED IN THE	42
AFGL PROGRAM	
APPENDIX A: Table of Observations	43
APPENDIX B: "Ground-Based Observation of Sources in the AFGL infrared Sky Survey"	59

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INTRODUCTION

This report summarizes the results of the UCSD group's ground-based, photometric observations of sources detected in the AFGL infrared sky survey. This report will be concerned principally with sources from the AFGL catalogue although the computer readouts enclosed with this report detail all UCSD observation, including those of many AFCRL objects excluded from the revised catalogue.

By agreement with the U. of Minnesota and U. of Wyoming groups, we observed the $40\text{--}60^{\text{m}}$ zone in each hour of right ascension. Practical declination limits were $+60^{\circ}$ (set by the yoke mount of the Mt Lemmon telescope) and -30° . These boundaries encompass $\sim 23\%$ of the total sky. There were 616 AFGL sources within these limits of which 271 were scanned. This included 99 of the 106 unknown sources.

There are six sections following this introduction: the first reviews the observational procedures; the second summarizes the observations; the third compares our observed magnitudes with those of the Air Force; the fourth discusses Air Force identification with IRC objects; while the fifth gives a rough classification of 616 sources within the observational boundaries. The final section evaluates the limits of completeness of the AFGL Survey.

OBSERVATIONAL PROCEDURE

All observations were made with the 1.5 m, $f/16$ telescope at Mt. Lemmon. All sources, whether known or unknown, were scanned for by first locating a chosen SAO star and then offsetting to the SW corner of a box $4'.5$ (EW) by $6'.0$ (NS) centered on the AFGL coordinates. This box size represents $\pm 2\sigma$ in each coordinate. The error box was then raster-scanned for the source. The scan rate was $40''/\text{sec}$. The aperture was $17''$ and the beam throw $26''$. A typical chopping frequency was 20-30 Hz. Upon completion of the raster, the telescope was again moved automatically to a second SAO star to serve as a check on the procedure. Scans were done primarily with a glass filter used with a Si(As) system. The scanning detection limit with this system was 5.0 mag at $3.5\ \mu\text{m}$. Some early scans were done with a InSb system with a detection limit of 7.0 mag at $3.5\ \mu\text{m}$.

If the source was detected, then broadband photometric data were obtained. Two different Si(As) systems were used with slightly different sets of broad band filters. Observations prior to May, 1978, were obtained with a downlooker system with the filters specified in Table 1, while measurements from May, 1978 were made with an uplooker system with filters shown in Table 2.

Some early observations with the InSb system included broadbands at 1.65, 2.3, and $3.5\ \mu\text{m}$. In addition, some spectrophotometry at $\Delta\lambda/\lambda \sim 2\%$ was obtained from $2-4\ \mu\text{m}$ and $8-13\ \mu\text{m}$ for some of the more unusual sources. These are given in the enclosed A. J. paper by Gosnell et al. (See Appendix B)

Some very red objects may have been missed by scanning at $3.5 \mu\text{m}$. However, it is computed that with the UCSD system a detection is more likely scanning at $3.5 \mu\text{m}$ than at $11.2 \mu\text{m}$ for an object warmer than 410 K.

Since the beam separation was only $26''$, it is likely that many of the real sources that were not detected were extended. This is evidenced by the failure to detect HII regions.

TABLE 1
BROAD BAND FILTERS
Si(As) DOWNLOOKER

<u>λ (μm)</u>	<u>Band Pass (μm)</u>
2.28	0.5
3.50	1.0
4.90	1.0
8.40	0.8
11.20	2.0
12.50	1.7

TABLE 2
BROAD BAND FILTERS
Si(As) UPLOOKER

<u>λ (μm)</u>	<u>Band Pass (μm)</u>
2.28	0.41
3.50	1.00
4.74	0.50
8.48	0.81
10.55	0.90
11.94	1.04
12.52	1.20

OBSERVATIONS

The objects we observed do not represent an unbiased sample of our section of the sky. An attempt was made to observe as many unknowns as possible (of the 106 all but 7 were scanned). Also preferential weighting was given to very red objects, sources with unexpected magnitudes, stars without known spectral types, and stars with shells. It was hoped to obtain photometry on all known Mira variables in the zone. Observations of bright stars and well investigated sources (e. g. IRC +10 216) received less emphasis.

The sources scanned are classified under the following headings: normal stars, shell stars, late-type variables without indication of shells, peculiar stars without indications of shells, non-stellar sources, unknowns which were found, unknowns not found, knowns which were not found, and stellar sources which were difficult to classify. (The expression "known" refers to any source associated by the AFGL with some previously detected objects. Sources classified as "not found" were those not detected in UCSD scans for which scanning procedures were correctly followed, i. e., the box scanned was correctly centered on the AFGL coordinates as indicated by the SAO stars.)

Normal stars are those which are not known variables and which rise less than 0.4 mag between 3.5 and 11 μ m. Shell stars show rises of 0.6 mag or greater. Peculiar stars without indication of shells are variables other than late-type variables (e. g. R CrB) or IRC sources with I-K values > 3.5 but 3.5 to 11 μ m rises of less than 0.4 mag.

There are two non-stellar sources associated with knowns. GL 4141 is identified as LHE 316. GL 4029 is incorrectly identified as LX Cas, an eclipsing variable, but is in fact a very red, multiple source which is being further investigated.

Three of the unknowns which were found, GL 2009, 2252, and 2287, were searched for but not located by other observers. One of the unknowns (GL 2999) which we were not able to find was located by another group.

Of the 11 knowns which were not detected in the scans, three (GL 998, 2046, and 2639) fall outside the $\pm 2\sigma$ error box. A third, GL 2304, was an extended source (W48).

Stellar sources which were not classified as either normal or shell are ones for which 10 μ m photometry were not obtained.

TABLE 3
OBSERVED NORMAL STARS

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
108	635	1293	2261
111	671	1372	2267
113	674	1378	2278
123	819	1379	2481
129	820	1387	2491
132	862	1438	2796
143	1001	1446	2828
262	1004	1509	2986
274	1191	1510	4007
276	1216	1583	4042
279	1218	1584	4139
377	1285	2235	4198
519	1289		

TABLE 4

OBSERVED STARS WITH SHELLS

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
122	527	999	1434	1743	2452
127	528	1009	1437	1793	2479
253	622	1028	1439	1801	2645
257	639	1043	1441	1805	2818
272	664	1045	1450	1806	2819
278	667	1049	1511	1818	2940
280	812	1050	1516	1905	2941
287	815	1052	1519	2037	2974
371	832	1173	1576	2040	3143
378	837	1184	1579	2241	3194
379	842	1288	1594	2254	4013
381	846	1298	1650	2270	4065
414	850	1301	1652	2289	4241
521	853	1302	1660	2300	4269
522	856	1376	1669	2443	4295
525	858	1380	1726		

TABLE 5

LATE TYPE VARIABLES WITH NO SHELLS

<u>AFGL</u>	<u>VARIABILITY</u>
120	V451 Cas
1880	UV Her (Mira)
2251	AB Aql (LG)

TABLE 6

PECULIAR STARS WITH NO INDICATIONS OF SHELLS

<u>AFGL</u>
314
357
404
512
624
643
661
4219

TABLE 7

NON-STELLAR OBJECTS

AFGL

4029

4141

TABLE 8

UNKNOWNNS FOUND

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
538	2015	2287	2636
809	2023	2290	2679
1039	2047	2445	2686
1894	2252	2477	4253
2009	2259	2494	4306

TABLE 9

AFGL UNKNOWNNS NOT FOUND

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
115	649	1027	1902	2681	4014
124	650	1033	1917	2824	4036
126	669	1188	2051	2939	4038
144	818	1292	2242	2961	4040
250	821	1295	2243	2999	4041
256	845	1392	2245	3008	4079
387	857	1444	2256	3139	4080
389	860	1453	2271	3144	4089
409	1002	1514	2303	3151	4184
412	1018	1523	2448	3178	4240
530	1020	1575	2455	4009	4242
621	1024	1659	2492	4010	4254
634	1026	1734	2670	4012	4257
645					

TABLE 10

KNOWN NOT FOUND

AFGL

823

998

1017

1038

1900

2046

2266

2304

2639

3159

3185

TABLE II

UNCLASSIFIED

AFGL

254

403

627

4138

A COMPARISON OF AFGL AND UCSD MAGNITUDES

The following two figures are histograms of the AFGL 4 μ m and 11 μ m magnitudes minus the UCSD magnitudes at roughly the same wavelength. The AFGL magnitudes are -0.40 brighter at 4 μ m and -0.42 brighter at 11 μ m. The dispersion of the curves about the mean value is 0.53 at 4 μ m and 0.84 at 11 μ m.

The UCSD 4.2 μ m magnitude was obtained by weighting the 3.5 μ m and either 4.7 μ m or 4.9 μ m fluxes inversely by their separation in wavelength from the AFGL filter. A careful correction for the CO in the 4.7 or 4.9 μ m bandpasses may produce better agreement between the two systems.

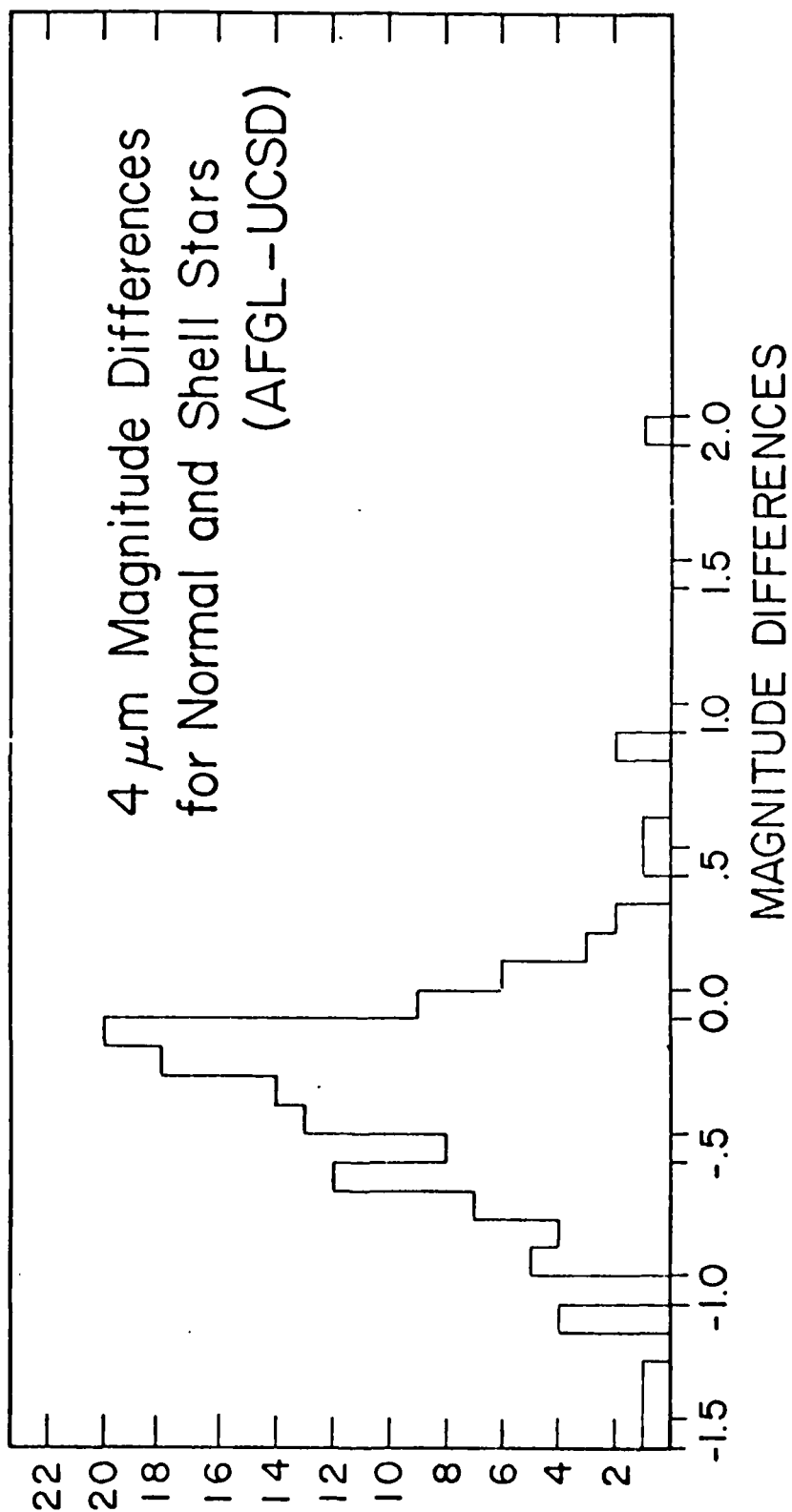
The UCSD 11.0 μ m magnitude was obtained from either the 11.2 μ m measurement or a simple mean of the 10.6, 11.9, and 12.5 μ m magnitudes.

The histograms include all sources, regardless of their apparent magnitude. In order to assess the accuracy of the AFGL data and to aid in estimating the level to which the survey is relatively complete, scatter plots of the 4 μ m and 11 μ m data were formed. With each is a table presenting the mean and standard deviation of the differences of the AFGL and UCSD magnitudes as a function of AFGL magnitude. Five sources with highly discrepant 11 μ m magnitudes which were omitted from the 11 μ m plot are listed in Table 14. They appear to be either spurious detections or else are regions of extended emissions.

To gain some idea of the contribution to the scatter due to variability

of the sources, the IRC-UCSD 2.2 μm magnitudes we plotted against AFGL 4 μm and 11 μm magnitudes. Two highly variable objects, R Lyn and SU Mon, are included in the 4 μm plot but not in Table 15. Their inclusion increases σ to 0.26.

The 4 μm plot includes sources detected only at 4 μm by the AFGL. From the plots and Tables 15 and 16 the greater variability of the 11 μm sources is apparent. Assuming the variations at longer wavelengths are no greater than at 2.2 μm , the contributions to the scatter at 4 μm and 11 μm are no larger than 0.20 and 0.40 magnitudes, respectively. This leaves errors of 0.35 mag at 4 μm and 0.45 mag at 11 μm to be accounted by AFGL and UCSD measurement errors and by systematic differences such as beam size.



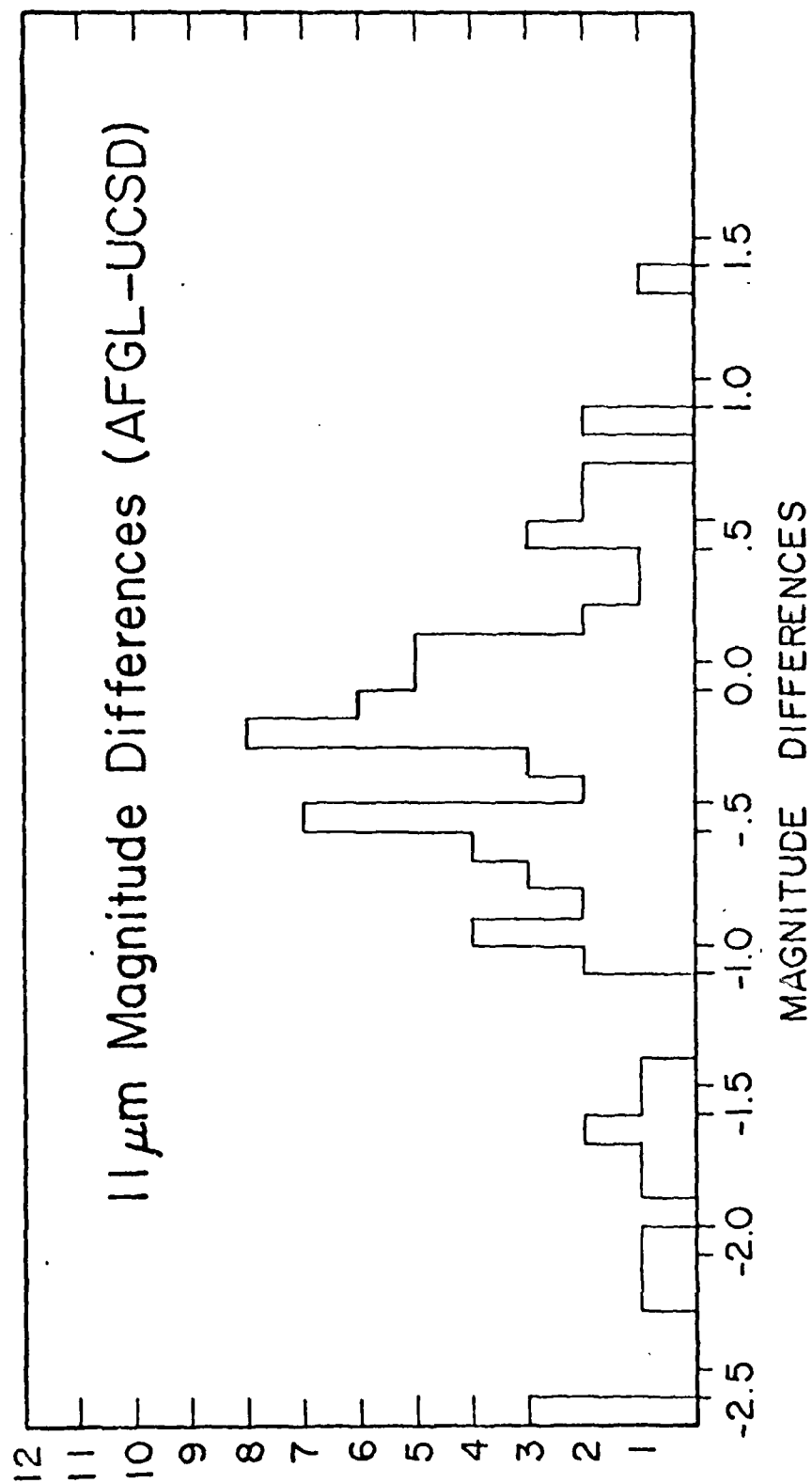


TABLE 12

AFGL 4 μm MAGNITUDES VERSUS AFGL (4 μm) - UCSD (3.5 μm) MAGNITUDES

AFGL mag	Number of Observations	Mean (AFGL-UCSD)	σ (AFGL-UCSD)
-1.0	8	-0.22	0.36
-0.5	11	-0.17	0.35
0.0	19	-0.16	0.35
0.5	27	-0.21	0.34
0.7	30	-0.24	0.33
0.8	34	-0.27	0.34
0.9	39	-0.24	0.38
1.0	41	-0.27	0.40
1.1	45	-0.26	0.39
1.2	53	-0.28	0.43
1.3	57	-0.29	0.44
1.5	68	-0.36	0.49

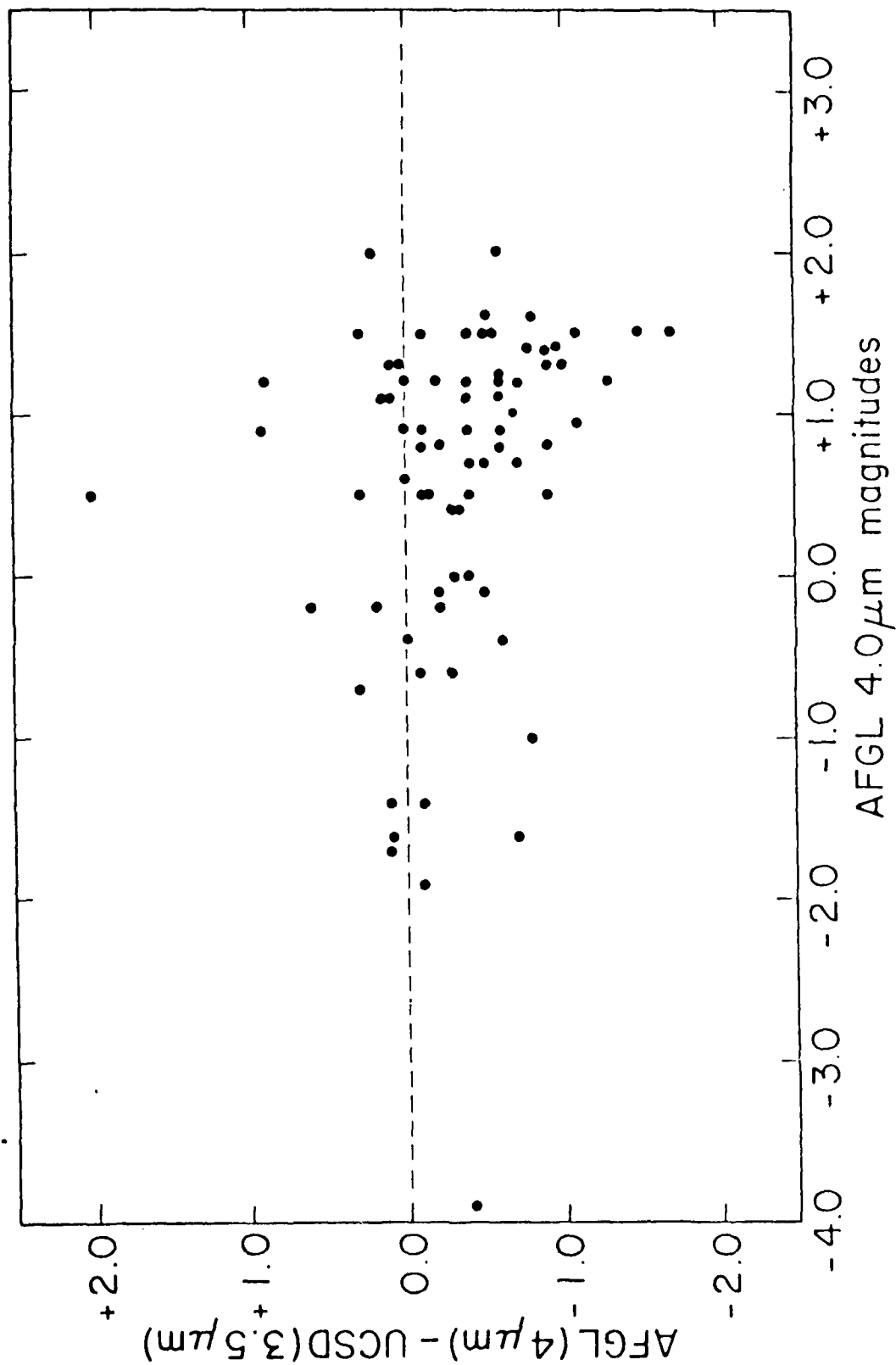


TABLE 13

AFGL 11 μ m MAGNITUDES VERSUS AFGL (11 μ m) - UCSD (11 μ m) MAGNITUDES

AFGL Mag	Number of Observations	Mean (AFGL-UCSD)	σ (AFGL-UCSD)
-2.4	12	0.22	0.49
-1.8	15	0.13	0.50
-1.6	21	-0.16	0.74
-1.5	24	-0.22	0.72
-1.4	27	-0.26	0.69
-1.3	36	-0.30	0.61
-1.2	41	-0.25	0.61
-1.1	49	-0.33	0.65
-1.0	53	-0.32	0.65

TABLE 14

OBJECTS WITH DISCREPANT MAGNITUDES AT 11 μm

AFGL #	AFGL (11 μm)	UCSD (11 μm)	AFGL (4 μm) - UCSD (3.5 μm)	IRC (2.2 μm) - UCSD (2.28 μm)
262	-1.0	1.6	-0.5	0.03
1191	-1.8	0.8	-0.2	-0.15
1438	-2.1	0.1	-0.3	-0.06
1805	-2.1	0.5	-0.5	0.00
2974	-1.5	0.5	-0.4	0.15

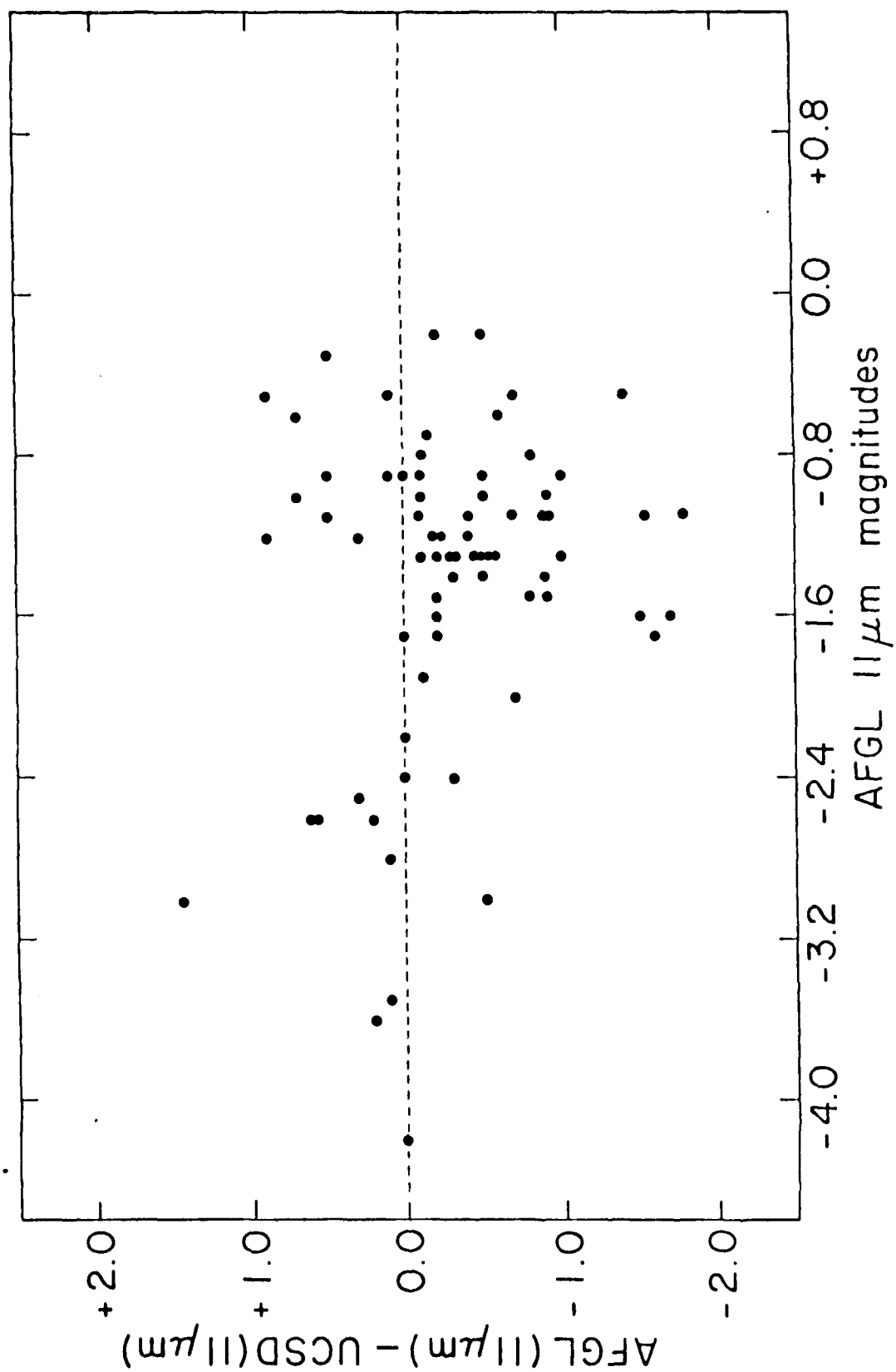


TABLE 15

AFGL 4 μm MAGNITUDES VERSUS IRC (2.2 μm) - UCSD (2.28 μm) MAGNITUDES

AFGL mag	Number of Observations	Mean (AFGL-UCSD)	α (AFGL-UCSD)
0.0	3	-0.08	0.07
0.5	7	-0.19	0.14
1.0	25	-0.12	0.20
1.5	58	-0.08	0.18
2.0	63	-0.08	0.18

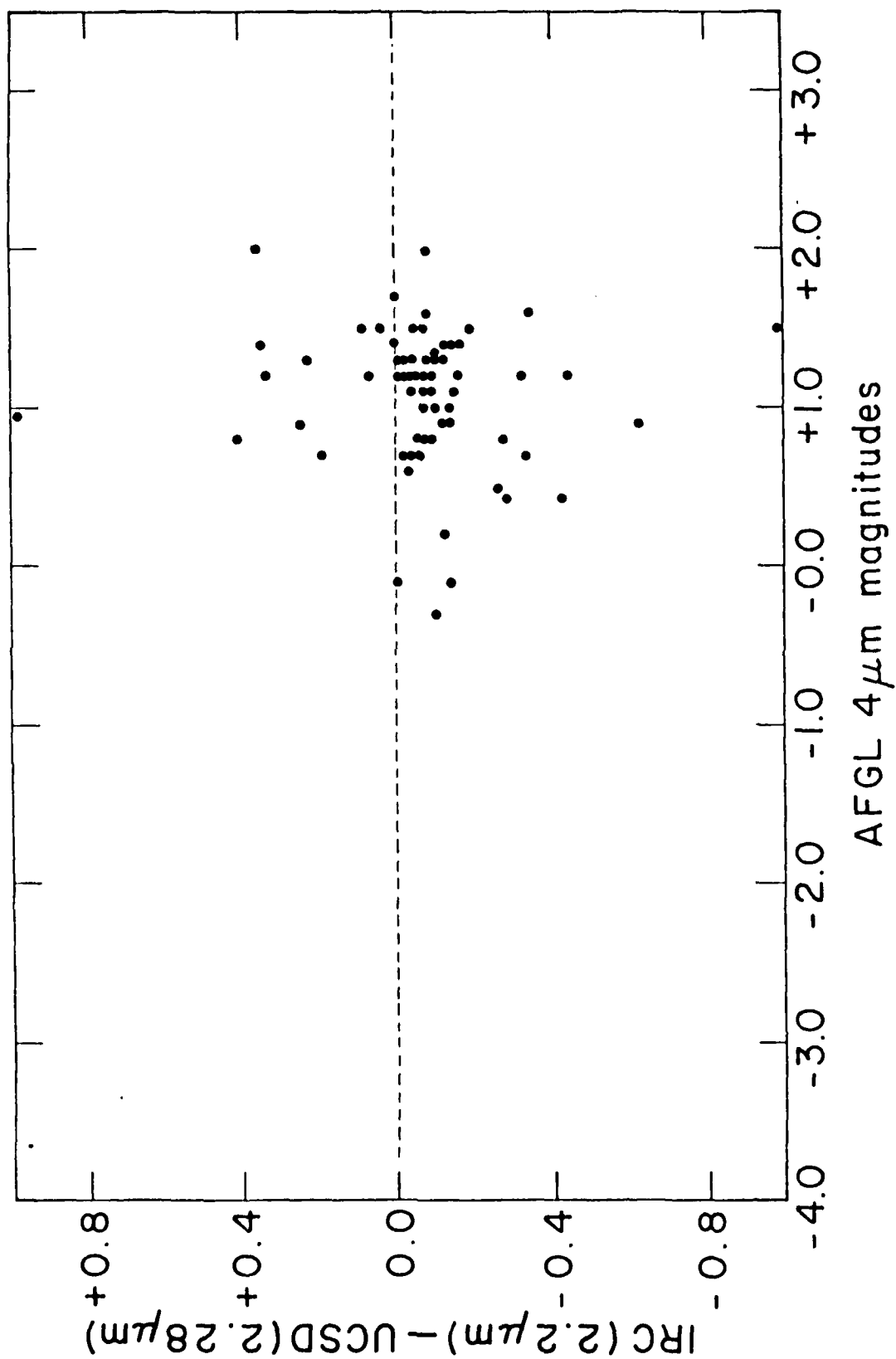


TABLE 16

AFGL 11 μm MAGNITUDES VERSUS IRC (2.2 μm) - UCSD (2.28 μm) MAGNITUDES

AFGL Mag	Number of Observations	Mean (AFGL-UCSD)	σ (AFGL-UCSD)
-2.4	11	-0.05	0.65
-1.8	16	-0.07	0.54
-1.6	21	-0.07	0.52
-1.5	25	-0.06	0.48
-1.4	28	-0.09	0.47
-1.3	34	-0.07	0.45
-1.2	38	-0.04	0.44
-1.1	47	-0.04	0.40
-1.0	53	-0.06	0.39
-0.9	60	-0.06	0.37

IDENTIFICATION WITH IRC SOURCES

We have attempted to check the identification of AFGL sources with IRC sources for the 166 such objects for which we have data.

Of the 166, 107 have K magnitudes within ± 0.20 mag of the IRC values. These are taken to be correctly identified as the IRC objects. Twelve more objects with magnitude differences outside these limits, but which were identified as SAO stars are confirmed as the IRC sources by positional agreement.

There are 31 sources which agreed in magnitude to within ± 0.30 mag of the IRC, or were brighter than the IRC values. These are designated as probable identifications.

The remaining 16 objects did not satisfy any of the above criteria. However, many of these are late-type variables and two are noted as variables in the IRC. There were no sources for which the AF identification with IRC objects were found to be in obvious error.

TABLE 17

AFGL OBJECTS CORRECTLY IDENTIFIED WITH IRC OBJECTS

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
108	371	674	1285	1509	2267
111	377	812	1288	1511	2278
113	378	819	1289	1519	2452
120	379	820	1293	1576	2479
123	381	832	1298	1583	2796
127	403	858	1302	1594	2818
129	414	862	1372	1650	2828
132	512	873	1378	1652	2932
143	519	999	1379	1669	2940
253	525	1001	1380	1726	2941
254	528	1004	1387	1801	2974
257	622	1009	1434	1805	3196
262	624	1043	1437	1889	4007
272	627	1045	1438	1905	4013
274	635	1184	1439	2037	4042
276	639	1191	1441	2235	4198
278	643	1216	1446	2254	4269
279	671	1218	1450	2261	

TABLE 18

AFGL OBJECTS CORRECTLY IDENTIFIED WITH IRC

OBJECTS BY POSITIONAL CORRELATION

<u>AFGL</u>	<u>SAO</u>
280	022817
517	024202
1050	026097
1173	153273
1510	043886
1511	043889
1660	182081
2481	143959
2491	069246
2819	164760
3140	053335
4139	062754

TABLE 19

AFGL IDENTIFICATIONS WITH IRC OBJECTS PROBABLE

<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>	<u>AFGL</u>
122	856	1660	2645
287	1028	1743	2819
517	1131	1818	2986
664	1173	2241	4138
667	1376	2251	4241
837	1510	2289	4269
842	1516	2443	4295
846	1579	2491	

TABLE 20

AFGL IDENTIFICATION WITH IRC NOT CERTAIN

<u>AFGL</u>	<u>Variability</u>
404	--
521	--
527	-- (K)
815	--
850	--
853	AZ Aur (Mira)
1050	R Lyn (Mira)
1052	RS Gem (SRb)
1793	BG Ser (Mira)
1806	Eu Lib (SR)
2040	T Dra (Mira)
2270	V2059 Sgr (Mira)
2300	ST Sgr (Mira)
2993	S Aqr (Mira) (K,I)
3143	EY And (Mira)
4065	X CMa (SRb)

BREAKDOWN OF OBJECTS IN OUR ZONE

As mentioned previously, the 271 objects we scanned for do not constitute an unbiased sample of our area of the sky. However, by using the AFGL magnitudes and identifications, I-K values from the IRC, and variability type a reasonably accurate breakdown can be made.

When this is done approximately 43% of the objects are found to be stars with shells and 37% to be stars without shells. Non-stellar knowns, mostly HII region, constitute 3%. Unidentified sources complete the total with 17%. Of the unidentified sources, 20% have been located through ground-based observations. A substantitally higher fraction could nevertheless be real if they are extended sources.

Of the unknowns detected, several are very red objects. Except for GL2659 and 2287, the preliminary observations of the sources have been reported by Gosnell et al.

THE LIMITS OF THE AFGL SURVEY

Unfortunately, the scatter plots of the previous section do not clearly determine the levels of statistical completeness of the surveys at 4 μm and 11 μm . To supplement these plots, this section presents tables of source counts versus apparent magnitude at the two wavelengths. Since the infrared data are not as severely affected by interstellar reddening as the optical and since the survey limits are not faint enough to see substantial decreases when looking towards high galactic latitude, the source number "N" versus apparent magnitude "m" should approximate a $\log N = 0.6m + \text{Constant}$ relationship. The source counts, taken from UCSD data, are tabulated in half magnitude increments. In fact, the slope is something less than 0.6 at both wavelengths. Despite this, and although the data is subject to uncertainties due to the number of sources, the 3.5 μm data clearly flattens out beyond +1.0 magnitude, while the 11 μm data turns over -0.5 magnitude. Combining these data with the scatter plots of the previous section yields a best estimate for the survey limits as +1.0 magnitude at 4 μm and -1.0 magnitude at 11 μm , subject to errors of a few tenths of a magnitude.

TABLE 21

3.5 μ m SOURCE COUNTS

UCSD Mag	N	Log N	$\Delta(\text{Log N})$
-3.5	1		
-3.0	1		
-2.5	0		
-2.0	0		
-1.5	4		
-1.0	4	0.60	0.0
-0.5	7	0.85	0.15
0.0	11	1.04	0.19
0.5	19	1.28	0.24
1.0	32	1.51	0.23
1.5	35	1.54	0.03
2.0	37	1.57	0.03
2.5	24	1.38	-0.19
3.0	5	0.70	-0.68

TABLE 22

11 μ m SOURCE COUNTS

UCSD Mag	N	Log N	$\Delta(\log N)$
-4.5	1		
-4.0	2		
-3.5	2		
-3.0	4		
-2.5	4		
-2.0	4	0.60	0.00
-1.5	6	0.78	0.18
-1.0	12	1.08	0.30
-0.5	20	1.30	0.22
0.0	10	1.00	-0.30
0.5	7	0.85	-0.15

UCSD PERSONNEL WHO PARTICIPATED IN THE AFGL PROGRAM

The program of photometry of AFGL sources at UCSD has been contributed to by a large number of people. Observations were made by A. H. Hewitt, Roc Cutri, Timothy R. Gosnell, Hugh S. Hudson, Paul D. LeVan, C. A. Lindsey, R. C. Puetter, Richard J. Rudy, B. T. Soifer, and S. P. Willner. Technical support was provided by Paul Brissenden, John Casler, Dawn Pedersen, Eileen Smith, Pat McCune, and R. W. Russell. Shane Burns aided in the data reduction.

APPENDIX A

This appendix presents computer readouts of all the UCSD observations. The photometry for each object is presented along with the date or dates of observation and possible identification of the source as an SAO star. Various comments are also included; a code for these comments is given on the following page. The observations are classified by which system they were taken with (downlooker or uplooker) since the filters differ slightly between systems as mentioned in the observational section.

UCSD OBSERVATIONS	
OF	
GL/CRL SURVEY SOURCES	
2-4 AND 6-14 DOWNLOKER OBSERVATIONS AS OF 05/13/79	
COMMENT CODES	
K	= KNOWN/OUR IDENTIFIED SOURCE
UN	= UNKNOWN/OUR UNIDENTIFIED SOURCE
EW	= EXTENDED OBJECT (WITH RESPECT TO THE CRL BEAM SIZE)
NV	= NOT VISIBLE (IN THE MT LEMMON 60 INCH)
S4	= SOURCE # ONE, ETC. (IF MORE THAN ONE IN BOX)
T4	= IMRUM UNE, ETC. (IE. HEAM SEPARATION # ONE)
N1	= NOT FOUND IN THE STANDARD ERROR BOX
F	= FOUND IN THE ERROR BOX
B	= BAD SCAN (IE. ERROR BOX INCORRECT, ETC.)
NB	= NARROW BAND OBSERVATIONS TAKEN
NOTE	= MAGNITUDES REPORTED IN TENTHS ARE APPROXIMATE
POSITION CODES	
A	= AFGL (NO FINDING CHART) - UA=3', DU=2'
B	= CATALOGUE OF BRIGHT STARS - UA=1', DU=1'
F	= AFGL (FINDING CHART EXISTS) - UA=3', DU=2'
I	= IRC - UA=1', DU=3'
S	= SAU - UA=0.5", DU=0.5"
U	= UCSD - UA=10", DU=10"
V	= GENERAL CATALOGUE OF VARIABLE STARS - UA=1', DU=1'

GL/CRL	POSITION (1450)	DATE (UI)	SAUS CUHM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CMD
0105	. .	10/12/76	NF UK	.	.	.	.	.	.	.	.	1
0108	00 43 25.7 +15	12/06/76	092072 K	.	0.29	.	0.05	0.27	0.10	-0.04	-0.04	2
0111	00 46 25.1 +07	12/06/76	109474 K	.	0.89	.	0.66	0.80	0.83	0.60	0.80	3
0113	00 46 18.9 +56	11/20/76	021738 K	.	2.30	.	2.03	2.10	2.05	1.90	.	4
0115	.	10/15/76	NF UK	.	.	.	.	.	.	.	.	5
0119	.	10/12/76	NF UK	.	.	.	.	.	.	.	.	6
0120	00 49 01.8 +59	11/20/76	021779 K	.	1.91	.	1.58	1.73	1.58	1.40	.	7
0122	00 49 23. .	12/05/76	F K	.	2.21	.	1.62	1.43	0.75	-0.21	-0.12	8
0123	00 50 27.0 -01	12/06/76	129009 K	.	1.08	.	0.85	1.07	0.99	0.94	0.85	9
0124	.	10/15/76	NF UK	.	.	.	.	.	.	.	.	10
0126	.	10/15/76	NF UK	.	.	.	.	.	.	.	.	11
0127	00 52 14.0 +48	12/10/76	036763 K	.	1.77	.	1.54	0.67	0.27	-0.30	-0.10	12
0129	00 52 33.8 +24	12/06/76	074365 K	.	1.13	.	0.87	1.10	0.91	0.77	0.83	13
0132	00 53 13.8 +57	12/08/76	021846 K	.	3.01	.	2.88	3.04	3.06	3.03	3.49	14
0143	00 58 7.2 -01	12/06/76	129076 K	.	1.67	.	1.42	1.64	1.48	1.35	1.34	15
0144	.	10/15/76	NF UK	.	.	.	.	.	.	.	.	16
0145	.	10/12/76	NF UK	.	.	.	.	.	.	.	.	17
0200	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	18
0203	01 47 14.1 +53	12/10/76	022663 K	.	0.88	.	0.54	0.67	0.27	-0.30	-0.10	19
0206	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	20
0207	01 50 33. .	12/08/76	F K	.	2.28	.	1.98	2.02	1.64	0.77	0.60	21
0202	01 51 41. .	10/16/76	F K	2.10	1.99	.	1.85	.	.	.	.	22
0204	01 54 22.9 +27	11/18/76	075048 K	1.71	2.06	.	1.80	2.17	1.84	1.62	.	23
0204	.	11/18/76	075048 K	.	1.51	.	1.29	1.64	1.33	1.33	.	24
0206	01 55 10.7 +30	10/16/76	055147 K	.	0.33	.	0.44	.	.	.	.	25
0206	.	11/20/76	055147 K	.	1.00	.	-0.09	0.10	-0.01	-0.10	.	26
0208	01 55 37.3 +45	12/05/76	037673 K	.	-0.98	.	-1.35	-1.44	-1.88	-2.70	-2.80	27
0209	01 50 11.7 -07	12/11/76	129540 K	.	2.15	.	2.17	1.80	1.80	1.75	2.37	28
0200	01 56 14.8 +54	12/05/76	022817 K	.	1.07	.	0.61	0.30	-0.06	-0.47	-0.57	29
0301	02 40 44. .	12/05/76	F K	.	2.09	.	2.30	2.02	0.32	-0.77	-0.60	31
0307	02 44 25.5 +29	12/05/76	075578 K	.	2.04	.	1.90	2.02	1.94	1.83	1.94	32
0308	02 45 32.1 -12	10/04/76	148612 K	.	0.34	.	0.47	0.05	-0.14	-0.75	-0.21	33
0309	02 45 32.0 +17	12/06/76	093115 K	.	0.33	.	-0.10	-0.10	-0.49	-0.94	-1.10	34
0301	02 46 25.3 +56	12/08/76	023647 K	.	2.10	.	1.48	1.24	0.31	-1.20	-1.21	35
0307	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	36
0309	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	37
0309	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	38
0312	.	10/11/76	NF UK	.	.	.	.	.	.	.	.	39
0316	.	10/25/77	F K	11.38	9.88	.	.	.	.	.	.	40

GL/CRL	PUSI UN (1150)	DA L (U)	SAD CUM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.2	CMD
0416	.	10/28/71	F K	.	.	.	10.41	.	.	3.82	.	41
0420	.	12/08/70	NF UK	.	.	.	.	.	.	.	.	42
0422	U3 40 +1.9 +12 38 11 S	12/06/70	093566 K	.	1.12	.	0.79	0.91	0.74	0.54	0.48	43
0419	U3 43 +0.5 -12 15 26 S	12/06/70	149158 K	.	0.37	.	0.13	0.21	0.16	0.01	0.00	44
0421	U3 44 +0.8 +20 41 32 S	12/08/70	024237 K	.	1.86	.	1.48	1.43	0.85	-0.11	0.02	45
0422	U3 45 52.1 +20 54 32 V	12/08/70	F K	.	2.72	.	1.99	1.74	1.30	0.82	0.61	46
0425	U3 46 20.8 -01 10 00 S	12/06/70	130743 K	.	0.88	.	0.57	0.64	0.42	0.10	-0.02	47
0430	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	48
0438	U3 58 +0.5 +56 56 20 U	10/12/70	F UK	5.25	5.80	.	5.45	.	.	.	.	49
0438	.	11/20/70	NF UK	.	.	.	.	.	.	.	.	50
0641	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	51
0642	U4 40 59.1 +20 40 08 I	12/06/70	F K	.	2.17	.	1.71	1.51	1.26	0.70	0.72	52
0644	U4 40 34.0 +32 46 24 S	12/05/70	057393 K	.	0.97	.	0.68	0.65	0.61	0.50	0.53	53
0644	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	54
0645	U4 46 32.4 +31 24 07 S	12/05/70	057447 K	.	1.53	.	1.26	1.33	1.31	1.21	1.32	55
0639	U4 48 23.1 +26 26 06 V	12/05/70	F K	.	1.17	.	0.63	0.70	0.26	0.02	0.04	56
0645	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	57
0649	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	58
0650	.	10/11/70	NF UK	.	.	.	.	.	.	.	.	59
0659	.	10/16/70	NF UK	.	.	.	.	.	.	.	.	60
0671	U4 58 37.1 +60 23	12/07/70	F K	.	2.15	.	1.97	1.90	1.84	1.81	2.11	61
0674	U4 58 59.1 +41 01	12/07/70	F K	.	0.22	.	0.05	0.09	0.00	-0.04	-0.02	62
0609	U5 40 33.3 +32 40 58 U	10/11/70	F UK	5.6	3.3	.	0.8	.	.	.	.	63
0609	.	10/16/70	F UK	6.63	4.17	.	1.67	.	1.50	2.10	.	64
0612	U5 42 09.7 +24 24 01 S	12/05/70	077502 K	.	3.46	.	1.67	0.33	1.50	2.10	.	65
0615	U5 44 03.1 +43 11 06 I	12/07/70	F K	.	1.83	.	1.11	1.23	0.30	0.00	0.00	66
0615	.	12/15/70	F K	.	3.23	.	1.47	0.44	-0.48	-0.90	-0.95	67
0618	.	12/10/70	NF UK	.	3.23	.	1.44	0.41	-0.44	-0.90	-0.95	68
0619	U5 44 35.5 -12 49 18 S	12/10/70	150808 K	.	1.61	.	1.29	1.41	1.35	1.13	1.10	69
0641	.	10/12/70	NF UK	.	.	.	.	.	.	.	.	71
0643	.	03/10/71	NF UK	.	.	.	.	.	.	.	.	72
0645	.	10/12/70	NF UK	.	.	.	.	.	.	.	.	73
0647	.	10/12/70	NF UK	.	.	.	.	.	.	.	.	74
0656	U5 58 33.1 +10 54 08 V	12/06/70	F K	.	1.33	.	0.87	0.70	0.37	-0.00	-0.20	75
0657	.	10/12/70	NF UK	.	.	.	.	.	.	.	.	76
0658	U5 59 16.1 -02 21 02 V	12/06/70	F K	.	-0.08	.	-0.43	-0.41	-0.81	-1.65	-1.59	77
0660	.	10/12/70	NF UK	.	.	.	.	.	.	.	.	78
0662	U5 59 47.3 +20 36 53 S	12/08/70	025540 K	.	2.41	.	2.05	2.20	2.03	1.99	1.91	79
0673	U6 03 33.1 -05 42 08 I	02/03/71	F K	NB	2.67	.	1.73	1.31	0.75	-0.15	-0.29	80

UNAVAILABLE.

A

NOT

GL/CRL	POSITION (1950)	DATE (UT)	SAUS#	CUMM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CHD
00/3	.	02/21/76	F	K	NV	11.44	8.71	.	5.00	.	.	.	61
00/8	.	12/07/76	NF	K	.	.	.	.	.	.	.	.	82
1001	06 40 51.4 +25 10 57 S	12/05/76	078682	K	.	0.24	.	0.02	0.17	-0.07	0.02	0.04	83
1002	06 41 35.4 +24 01 24 S	12/10/76	NF	UK	.	.	.	1.94	2.03	2.03	1.80	1.62	84
1004	.	12/05/76	078692	K	.	2.12	.	.	.	.	.	.	85
1005	.	12/07/76	NF	UK	.	.	.	.	.	.	.	.	86
1006	.	12/10/76	NF	UK	.	.	.	.	.	.	.	.	87
1011	.	12/10/76	NF	UK	.	.	.	.	.	.	.	.	88
1013	.	11/18/76	NF	UK	.	.	.	.	.	.	.	.	89
1015	.	12/10/76	NF	UK	.	.	.	.	.	.	.	.	90
1016	.	11/18/76	NF	UK	.	.	.	.	.	.	.	.	91
1019	.	12/10/76	NF	UK	.	.	.	.	.	.	.	.	92
1020	.	11/18/76	NF	UK	.	.	.	.	.	.	.	.	93
1023	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	94
1044	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	95
1026	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	96
1027	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	97
1029	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	98
1031	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	99
1031	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	100
1032	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	101
1033	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	102
1039	06 53 09.7 -02 16 16 U	02/06/77	NF	UK	.	4.37	.	2.46	1.40	0.31	-0.04	0.02	103
1046	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	104
1048	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	105
1049	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	106
1054	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	107
1074	07 05 20. -10 49 45 I	02/03/77	F	K	.	3.73	.	2.43	1.73	0.42	-0.42	-0.52	108
1131	07 27 01. -19 21 44 I	02/03/77	F	K	.	2.08	.	0.83	0.20	-0.82	-1.33	-1.23	109
1100	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	110
1102	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	111
1108	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	112
1109	.	02/22/76	NF	UK	.	.	.	.	.	.	.	.	113
1109	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	114
1171	07 48 17.1 +31 32 25 S	02/12/77	060340	K	.	1.20	.	0.97	1.04	0.94	0.87	0.84	115
1172	.	02/08/77	NF	K	.	.	.	.	.	.	.	.	116
1173	.	02/08/77	NF	UK	.	.	.	.	.	.	.	.	117
1174	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	118
1177	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	119
1177	.	02/07/77	NF	UK	.	.	.	.	.	.	.	.	120

DO NOT

TABLE

A

DO NOT

GL/CRL	MUSIUN (1950)	DATE (UT)	SAUS CUMM	1.65	2.28	3.2	3.5	4.9	8.4	11.4	14.2	CMD
1216	07 58 40.7 +01 15 09 S	12/06/76	135380 K	.	1.27	.	1.03	1.00	0.90	1.00	0.90	121
1218	07 59 39.9 +02 28 24 S	12/06/76	116260 K	.	1.51	.	1.29	1.33	1.23	1.33	1.20	122
1205	08 41 30.7 +16 20 22 S	12/05/76	098087 K	.	1.53	.	1.39	1.42	1.31	1.46	1.44	123
1208	08 43 46.0 +01 48 57 S	12/06/76	117103 K	.	0.24	.	0.11	0.00	0.51	-1.22	-1.31	124
1209	08 44 37.8 +06 36 12 S	12/06/76	117112 K	.	1.57	.	1.47	1.41	1.32	1.41	1.31	125
1290	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	126
1292	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	127
1293	08 45 34.7 +12 43 58 S	12/05/76	098143 K	.	1.91	.	1.67	1.63	1.63	1.44	1.60	128
1295	.	12/05/76	NF UK	.	.	.	.	.	.	.	.	129
1297	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	130
1298	08 52 34.0 +17 25 22 S	02/12/77	098230 K	.	0.39	.	0.14	0.00	0.67	-0.81	-0.83	131
1301	08 53 40.9 +20 02 30 S	02/06/77	080524 K	.	1.03	.	0.25	0.17	0.61	-0.73	-0.61	132
1302	08 55 31.1 +11 02 23 S	02/08/77	098260 K	.	0.25	.	0.04	0.03	0.39	0.80	0.93	133
1305	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	134
1302	09 41 00.6 +14 15 05 S	12/08/76	098733 K	.	1.20	.	0.90	1.00	0.97	0.93	0.90	135
1303	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	136
1305	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	137
1306	09 42 34.7 +34 44 34 S	12/05/76	061669 K	.	0.21	.	0.97	1.43	1.95	-2.72	-2.84	138
1307	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	139
1308	09 43 00.1 +51 21 32 S	12/08/76	027377 K	.	0.33	.	0.02	0.13	0.03	0.03	0.02	140
1309	09 43 31.8 +06 56 25 S	12/06/76	117898 K	.	1.67	.	1.46	1.62	1.46	1.33	1.31	141
1300	09 44 24.2 +11 39 42 S	12/05/76	098769 K	.	2.47	.	3.09	3.30	3.80	4.40	4.57	142
1302	.	12/06/76	NF UK	.	.	.	.	.	.	.	.	143
1303	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	144
1304	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	145
1305	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	146
1307	09 51 05.4 +06 11 41 S	03/12/77	117975 K	1.48	1.47	1.10	1.05	.	.	.	.	147
1390	.	03/10/77	NF UK	.	.	.	.	.	.	.	.	148
1391	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	149
1392	.	12/07/76	NF UK	.	.	.	.	.	.	.	.	150
1437	10 46 10.0 +00 55 08 V	02/08/77	F K	.	1.82	.	1.47	1.34	0.93	0.13	0.33	151
1441	10 50 59.0 +13 58 09 V	02/08/77	F K	.	2.61	.	1.85	1.20	0.62	-0.30	-0.37	152
1441	.	03/13/77	F K NB	.	2.19	.	1.42	1.00	0.33	0.62	0.64	153
1441	.	03/15/77	F K NB	2.58	2.09	.	1.56	1.20	.	.	.	154
1444	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	155
1446	10 53 23.7 +06 27 09 S	02/08/77	118576 K	.	0.71	.	0.95	0.88	1.00	-1.10	-1.10	156
1453	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	157
1507	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	158
1511	11 44 36.1 +43 44 57 S	02/08/77	043889 K	.	0.98	.	0.62	0.43	0.06	0.90	-1.04	159
1511	.	03/13/77	F K NB	.	0.78	.	0.38	0.40	0.03	-0.97	-1.07	160

GL/CRL	POSITION (1950)	DATE (UT)	SAUS CUMH	1.65	2.28	3.2	3.5	4.9	8.4	11.2	14.5	CMD
1514	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	161
1518	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	162
1520	.	02/22/78	NF UK	.	.	.	.	.	.	.	.	163
1522	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	164
1523	.	06/10/76	NF UK	.	.	.	.	.	.	.	.	165
1524	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	166
1528	.	02/06/77	NF UK	.	.	.	.	.	.	.	.	167
1529	.	02/06/77	NF UK	.	.	.	.	.	.	.	.	168
1530	.	06/09/76	NF UK	.	.	.	.	.	.	.	.	169
1573	.	02/06/77	NF UK	.	.	.	.	.	.	.	.	170
1574	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	171
1575	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	172
1577	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	173
1576	12 42 47.0 +45 42 +8 V	06/07/76	F K	.	.	.	.	.	.	.	.	174
1579	12 44 46.0 +04 25 +1 V	02/12/77	F K	.	1.81	.	0.74	-0.20	-1.11	-1.70	-1.70	175
1578	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	176
1580	.	03/10/77	NF UK	.	.	.	.	.	.	.	.	177
1582	.	02/07/77	NF UK	.	.	.	.	.	.	.	.	178
1587	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	179
1590	.	02/08/77	NF UK	.	.	.	.	.	.	.	.	180
1594	13 00 46.0 +05 27 +2 V	02/12/77	F K	.	-0.99	.	-1.37	-1.55	-1.95	-2.74	-2.90	181
1594	.	03/13/77	F K NB	.	-1.10	.	-1.55	-1.94	-2.82	-2.94	.	182
1594	.	03/15/77	F KN B	.	.	.	-1.44	-1.40	.	.	.	183
1644	.	03/12/77	NF UK	.	.	.	.	.	.	.	.	184
1645	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	185
1646	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	186
1647	.	06/10/76	NF UK	.	.	.	.	.	.	.	.	187
1649	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	188
1625	.	02/22/78	NF UK	.	.	.	.	.	.	.	.	189
1627	.	02/22/78	NF UK	.	.	.	.	.	.	.	.	190
1629	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	191
1602	.	03/12/77	NF UK	.	.	.	.	.	.	.	.	192
1604	.	06/10/76	NF UK	.	.	.	.	.	.	.	.	193
1605	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	194
1607	.	02/22/78	NF UK	.	.	.	.	.	.	.	.	195
1608	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	196
16/1	13 58 16.7 +34 16 17 S	06/11/76	063881 UK	3.86	3.73	3.62	3.62	.	.	.	.	197
16/2	.	03/12/77	NF UK	.	.	.	.	.	.	.	.	198
16/4	.	02/22/78	NF UK	.	.	.	.	.	.	.	.	199
1743	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	200

GL/CRL	POSITION (1050)	DATE (UL)	SAGS CUMM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CMD
1745	.	06/07/76	NF UK E0	.	.	.	.	.	.	.	.	201
1747	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	202
1749	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	203
1751	.	06/11/76	NF UK	.	.	.	.	.	.	.	.	204
1755	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	205
1757	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	206
1758	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	207
1759	.	06/10/76	NF UK	.	.	.	.	.	.	.	.	208
1742	.	02/22/76	NF UK	.	.	.	.	.	.	.	.	209
1802	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	210
1808	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	211
1813	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	212
1815	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	213
1804	.	06/07/76	NF UK E0	.	.	.	.	.	.	.	.	214
1807	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	215
1801	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	216
1802	.	06/12/76	NF UK E0	.	.	.	.	.	.	.	.	217
1822	17 04 33	06/07/76	F UK	.	.	.	.	.	.	.	.	218
2009	17 04 33	06/07/76	F UK E0	.	.	.	.	.	.	.	.	219
2009	17 45 45.5	06/09/76	185788 UK	5.09	4.86	4.65	4.69	.	.	.	.	220
2009	.	06/10/76	185788 UK NB	5.23	5.08	4.97	4.88	.	.	.	.	221
2009	.	06/11/76	185788 UK NB	5.15	4.94	5.08	4.67	.	.	.	.	222
2015	17 47 49	06/07/76	F UK	.	.	.	.	.	.	.	.	223
2022	.	06/12/76	NF UK	.	.	.	.	.	.	.	.	224
2023	17 51 15	06/07/76	F UK	.	.	.	.	.	.	.	.	225
2023	.	06/12/76	F UK S1	8.1	6.6	.	3.5	.	.	.	.	226
2023	.	06/12/76	F UK S2	6.8	5.6	5.1	4.9	.	.	.	.	227
2047	17 57 24.3	06/07/76	F UK NV	.	.	.	.	.	.	.	.	228
2047	.	06/09/76	F UK NV	6.59	4.51	2.92	2.51	.	.	.	.	229
2047	.	06/10/76	F NB NV	6.71	4.65	3.04	2.53	.	.	.	.	230
2047	.	10/03/77	F UK	.	.	.	.	.	.	.	.	231
2051	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	232
2042	.	06/07/76	NF UK	.	.	.	.	.	.	.	.	233
2249	18 45 43	06/08/76	NF UK S1	.	.	.	.	.	.	.	.	234
2252	.	06/11/76	F UK S1	7.72	6.08	.	4.21	.	.	.	.	235
2252	.	06/12/76	F S1 NB	.	6.19	.	.	.	.	.	.	236
2252	18 45 43.7	06/07/76	F UK S2	3.98	2.84	2.16	1.81	.	.	.	.	237
2252	.	06/09/76	F UK S2	.	.	.	.	.	.	.	.	238
2252	.	06/09/76	F UK S2	.	.	2.07	.	.	.	.	.	239

ADICABLE

DO NOT

GL/CRL	POSITION (1950)	DATE (UT)	SAO#	CUMM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CMD
2252	.	06/10/76	F	S2 NB	4.06	3.05	2.12	1.89	.	.	.	.	241
2253	.	06/09/76	NF	UK	.	.	.	.	.	.	.	.	242
2277	.	06/07/76	NF	UK	.	.	.	.	.	.	.	.	243
2438	.	11/19/76	NF	UK	.	.	.	.	.	.	.	.	244
2442	.	06/07/76	NF	UK	.	.	.	.	.	.	.	.	245
2445	19 42 21.0 435 07 49 F	06/07/76	F	UK	.	.	.	.	.	.	.	.	246
2445	.	10/03/77	F	UK	.	.	.	.	.	.	.	.	247
2448	.	06/07/76	NF	UK	.	.	.	.	.	.	.	.	248
2425	.	06/08/76	NF	UK	.	.	.	.	.	.	.	.	249
2425	.	10/16/76	NF	UK	.	.	.	.	.	.	.	.	250
2470	.	06/07/76	NF	UK	.	.	.	.	.	.	.	.	251
2477	19 54 20.0 430 35 57 U	12/10/76	F	UK	.	8.66	.	4.61	1.87	-1.23	-1.97	-2.23	252
2478	.	10/16/76	NF	UK	.	.	.	.	.	.	.	.	253
2481	.	06/07/76	F	K	.	.	.	.	.	.	.	.	254
2481	19 55 25.0 403 41 24 S	06/11/76	143959 K	.	2.25	2.03	1.89	1.84	.	.	.	.	255
2489	.	10/16/76	NF	UK	.	.	.	.	.	.	.	.	256
2492	.	10/16/76	NF	UK	.	.	.	.	.	.	.	.	257
2494	19 59 41.0 440 45 47 F	06/07/76	F	UK	.	.	.	.	.	.	.	.	258
2494	.	10/03/77	F	UK	.	.	.	.	.	.	.	.	259
2636	20 40 47.0 442 45 52 U	06/11/76	F	UK NV	8.76	6.97	5.61	5.34	.	.	.	.	260
2636	.	06/12/76	F	NV NB	.	7.07	.	.	.	.	.	.	261
2636	.	11/20/76	NF	UK	.	.	.	.	.	.	.	.	262
2636	.	12/11/76	F	UK	.	.	.	.	.	.	.	.	263
2636	.	12/03/79	F	UK	8.95	7.18	.	9.69	5.74	2.99	2.50	2.24	264
2638	.	06/07/76	NF	UK EQ	.	.	.	.	.	.	.	.	265
2638	.	12/10/76	NF	UK	.	.	.	.	.	.	.	.	266
2639	.	10/11/76	F	UK NB	.	.	.	.	.	.	.	.	267
2639	20 54 25.8 437 13 45 U	10/16/76	F	UK NB	5.17	3.73	.	2.25	.	.	.	.	268
2639	.	11/18/76	F	UK	.	3.67	.	2.12	1.34	0.40	-0.12	.	269
2681	.	06/08/76	NF	UK	.	.	.	.	.	.	.	.	271
2688	20 57 00.7 427 14 42 U	10/11/76	F	UK	5.51	3.00	.	0.51	-0.84	-2.24	-3.00	.	272
2688	.	10/16/76	F	UK	.	2.93	.	0.36	.	.	.	.	273
2709	21 38 12.0 450 00 48 V	12/16/76	F	K NB	7.15	4.81	.	2.45	.	-0.39	-0.90	-1.40	274
2709	.	10/24/77	F	K	.	.	.	.	.	.	.	.	275
2824	.	06/08/76	NF	UK	.	.	.	.	.	.	.	.	276
2932	22 38 34.0 449 45 46 V	10/12/76	F	K	2.26	.	.	.	.	.	.	.	277
2932	22 38 34.0 449 45 46 V	11/16/76	F	K	.	1.68	.	1.32	1.30	0.93	-0.04	.	278
2939	.	10/11/76	NF	UK	.	.	.	.	.	.	.	.	279
2940	22 40 37.0 427 53 42 S	12/05/76	090732 K	.	.	1.19	.	0.89	1.02	0.77	0.24	0.30	280

DO NOT

GL/CRL	POSITION (1450)	DATE (UI)	SAU/CUMM	1.65	2.2	3.2	3.5	4.9	8.4	11.4	14.5	CHK
2441	42 41 10	12/10/70	F K		2.24		1.48	1.11	0.14	0.64	0.51	281
2444	"	10/16/70	NF UK									282
2424	"	12/10/70	NF UK									283
2461	"	12/10/70	NF UK									284
2449	"	10/15/70	NF UK									285
3008	"	10/15/70	NF UK									286
3139	"	10/15/70	NF UK									287
3140	23 43 10.6 +41 46 52 S	12/05/70	053335 K		1.88		1.55	1.70	1.62	1.20	1.10	288
3143	23 42 32 +43 48 +8 Y	12/10/70	F K		2.30		1.48	1.01	0.01	1.14	1.01	289
3144	"	10/11/70	NF UK									290
3144	"	10/16/70	NF UK									291
3151	"	10/16/70	NF UK									292
3178	"	12/11/70	NF UK									293
3178	23 58 +1.9 +0.0 04 -37 S	12/10/70	021002 K		0.54		0.23	0.30	0.00	0.18	0.03	294
4009	"	10/11/70	NF UK									295
4010	"	10/11/70	NF UK									296
4012	"	10/11/70	NF UK									297
4013	01 52 +7.6 +10 56 +1 S	10/16/70	092697 K	2.20	1.90		1.93					298
4013	"	11/18/70	092697 K		1.91		1.61	1.70	0.90	0.00		299
4029	02 57 +2.5 +60 17 +22 U	10/12/70	F K	9.30	6.87		4.80					300
4029	"	10/15/70	F K	9.58	7.22							301
4029	"	11/18/70	NF K									302
4029	"	11/20/70	NF K									303
4029	"	12/16/70	F K		6.96		4.76	3.47	1.94	1.61	1.09	304
4029	"	10/03/77	F K									305
4029	"	10/24/77	F K	10.06	9.01							306
4029	"	10/25/77	F K	9.37	6.92							307
4029	"	10/25/77	F K		9.05							308
4029	"	10/26/77	F K				4.70			1.41		309
4029	"	10/26/77	F K		8.84		7.02	6.50	2.34	2.14	1.70	310
4036	"	10/11/70	NF UK									311
4038	"	10/11/70	NF UK									312
4040	"	10/11/70	NF UK									313
4041	"	10/11/70	NF UK									314
4080	"	02/08/77	NF UK									315
4089	"	12/10/70	NF UK									316
4139	11 52 +9.3 +37 02 +7 S	02/08/77	062754 K		2.17		1.93	1.90	1.69	1.74	1.87	317
4166	"	02/22/70	NF UK									318
4166	"	02/21/70	NF UK									319
4253	19 45 +1.7 +0.0 20 +9 U	10/16/70	F K	9.42	7.04		4.17					320

GL/CRL	POSITION (145U)	DATE (UI)	SAUS CUMM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.2	CMD
4223	.	11/20/76	F UK	.	6.6	.	.	2.5	.	0.1	.	321
4224	.	10/16/76	NF UK	.	.	.	.	.	.	.	.	322
4227	.	10/16/76	NF UK	.	.	.	.	.	.	.	.	323
4227	.	11/20/76	NF UK	324
4245	22 59 47. 410 20 .0 I	12/11/76	F K	.	3.04	.	1.98	1.10	-0.04	-0.93	-0.53	325

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GL/CRL	POSITION (1950)	DATE (UT)	SAUS CUM	2.3	3.5	4.7	4.9	8.5	10.6	11.4	12.5	CMD
0274	.	09/24/78	148049 K	2.41	2.19	2.48	.	2.27	1.82	.	.	1
0272	.	09/20/78	167416 K	1.7	1.9	2.2	.	2.0	1.2	1.8	.	2
0263	.	09/20/78	148144 K	.	.	.	.	.	.	.	.	3
0267	.	09/24/78	129624 K	-0.23	-0.57	-0.31	.	-0.53	-0.81	-0.60	-0.46	4
0403	.	09/24/78	F K	1.43	1.34	1.46	.	1.21	1.18	0.91	1.36	5
0404	.	09/25/78	F K	1.6	1.0	1.2	.	1.2	0.9	0.8	0.9	6
0414	.	09/25/78	F K	1.5	1.0	0.8	.	0.6	0.5	0.0	.	7
0517	.	10/14/78	024202 K	1.6	1.7	1.9	.	1.7	.	.	.	8
0527	.	09/21/78	F K	2.76	0.81	.	.	-1.12	-1.34	-1.48	-1.37	9
0528	.	09/21/78	F K	1.40	0.99	0.82	.	0.46	-0.24	-0.36	-0.35	10
0627	.	09/24/78	F K	2.08	1.70	1.88	.	.	.	.	.	11
0643	.	10/15/78	057472 K	1.4	1.3	1.6	.	1.5	.	.	.	12
0661	.	09/20/78	F K S1	.	3.1	3.3	.	.	.	.	.	13
0661	.	09/20/78	F K S2	.	5.4	5.9	.	.	.	.	.	14
0664	.	10/15/78	F K	-0.7	-1.5	-2.1	.	-2.9	-4.2	-4.1	-4.2	15
0667	.	09/20/78	150058 K	-0.2	-0.6	-1.1	.	-2.5	-2.5	.	.	16
0618	.	09/24/78	F K	.	.	.	.	.	.	.	.	17
0620	.	09/25/78	170834 K	2.6	2.3	2.3	.	2.6	2.4	2.0	.	18
0632	.	02/11/79	F K	1.45	1.21	1.03	.	0.60	0.77	0.00	-0.00	19
0637	.	10/11/78	F K	-0.9	-1.5	-1.9	.	-2.4	-3.3	-3.2	-3.1	20
0642	.	10/11/78	F K	2.0	1.5	0.9	.	0.4	-0.8	-0.8	-0.6	21
0646	.	09/25/78	18 SAU S1	.	1.8	2.0	.	1.9	1.7	1.5	1.0	22
0646	.	09/25/78	F K S2	.	.	.	.	.	.	.	.	23
0620	.	02/14/79	F K	3.61	2.49	1.53	.	0.67	-0.10	-0.17	-0.15	24
0623	.	02/10/79	F K	3.04	2.41	1.45	.	0.90	0.29	0.14	0.21	25
0628	.	02/17/79	NF K	.	.	.	.	.	.	.	.	26
0649	.	02/14/79	F K	1.33	0.93	0.81	.	0.64	-0.02	-0.13	-0.20	27
1009	.	02/18/79	F K	1.87	1.34	1.02	.	0.74	0.36	-0.23	0.20	28
1017	.	02/14/79	NF K	.	.	.	.	.	.	.	.	29
1028	.	02/10/79	F K	0.47	-0.62	-1.42	.	-2.27	-3.27	-3.20	-3.15	30
1038	.	02/14/79	NF K	.	.	.	.	.	.	.	.	31
1038	.	02/18/79	NF K	.	.	.	.	.	.	.	.	32
1043	.	02/10/79	F K	1.95	1.46	0.90	.	0.53	-0.13	-0.24	-0.15	33
1045	.	02/18/79	F K	1.66	1.18	0.89	.	0.32	0.11	-0.14	0.01	34
1049	.	02/18/79	114704 K	.	1.18	0.89	.	0.32	0.11	-0.14	0.00	35
1020	.	02/17/79	026097 K	2.95	2.22	1.81	.	1.36	-0.77	-0.67	0.65	36
1022	.	02/18/79	F K	2.82	2.40	2.34	.	2.20	2.06	1.76	1.75	37
1173	.	02/18/79	153273 K	1.63	1.27	1.43	.	1.01	0.73	0.61	0.65	38
1184	.	02/10/79	F K	2.44	1.81	1.33	.	0.93	0.01	0.02	0.03	39
1434	.	02/13/79	F K	2.30	1.77	1.67	.	1.27	0.84	0.59	0.97	40

GL/CRL	POSITION (1950)	DATE (UT)	SAOS CUMM	2.3	3.5	4.7	4.9	8.5	10.6	11.9	12.5	CRD
1438	.	02/13/79	F K	0.33	0.22	0.32	.	0.24	0.05	0.14	.	41
1439	.	02/13/79	F K	0.44	-1.08	-1.93	.	-3.14	-3.74	-3.92	-3.83	42
1420	.	02/14/79	F K	.	-1.81	-1.85	0.21	-2.22	-3.03	-2.55	-3.49	43
1509	11 43 17.3 +06 48 J5 S	05/31/78	119035 K	0.01	0.03	.	.	.	.	.	.	44
1510	11 43 25.0 +48 03 24 S	05/31/78	043880 K	0.67	0.73	.	1.02	.	.	.	.	45
1516	.	02/17/79	F K	0.36	0.26	0.11	.	-0.10	-0.66	-0.70	-0.64	46
1519	.	02/17/79	028194 K	0.77	0.41	0.11	.	-0.21	-0.70	-0.94	-0.89	47
1576	.	02/10/79	F K	-0.93	-1.62	-1.43	0.57	-2.10	-2.16	-2.31	-2.20	48
1503	12-51 +57 -04 16	05/31/78	F K	0.37	0.26	.	.	.	.	.	.	49
1504	.	02/17/79	F K	.	.	.	.	1.31	.	.	.	50
1620	.	02/13/79	F K	-3.11	-3.64	-3.75	.	-4.11	-4.81	-4.90	-4.90	51
1622	.	02/10/79	F K	0.73	0.04	-0.40	.	-0.70	-1.19	-1.34	-1.40	52
1600	13 52 29.9 -26 11 13 S	05/30/78	182081 K	1.12	1.31	.	1.36	0.97	0.43	0.67	0.32	53
1609	.	02/14/79	F K	1.49	1.28	1.14	.	0.75	0.34	0.20	-0.10	54
1746	.	02/14/79	F K	2.90	2.68	2.45	.	2.30	0.69	0.71	1.51	55
1730	.	05/29/78	NF UK	.	.	.	.	.	.	.	.	56
1744	.	02/14/79	NF UK	.	.	.	.	.	.	.	.	57
1743	14 55 22.6 -12 14 15 S	05/30/78	158929 K	-0.08	-0.07	.	0.04	-0.37	-1.00	-1.17	-1.01	58
1773	.	02/10/79	F K	0.73	0.16	-0.17	.	-0.51	-1.15	-1.31	-1.30	59
1775	.	05/29/78	NF UK	.	.	.	.	.	.	.	.	60
1801	15 48 23.2 +15 17 02 S	05/30/78	101771 K	0.05	-0.31	.	-0.55	-0.90	-1.61	-1.69	-1.70	61
1805	.	02/14/79	F K	1.77	1.77	2.12	.	1.31	0.84	.	0.20	62
1806	.	02/17/79	F K	2.41	2.18	1.95	.	1.61	0.80	0.74	0.64	63
1812	.	05/29/78	NF UK	.	.	.	.	.	.	.	.	64
1818	.	02/17/79	F K	2.89	2.28	1.28	.	0.30	-0.90	-0.70	-0.61	65
1809	.	05/13/79	F K	1.76	1.24	0.90	.	0.54	0.93	.	.	66
1874	.	05/12/79	NF K	.	.	.	.	.	.	.	.	67
1900	.	05/12/79	NF K	.	.	.	.	.	.	.	.	68
1905	.	05/12/79	F K	1.58	1.02	0.70	.	0.30	-0.03	0.01	-0.07	69
1917	.	05/13/79	NF UK	.	.	.	.	.	.	.	.	70
2037	.	05/12/79	F K	1.56	0.94	0.49	.	0.07	-0.85	-0.94	-0.94	71
2046	.	05/12/79	NF K	.	.	.	.	.	.	.	.	72
2235	.	09/24/78	IS SAUK	-0.40	-0.59	-0.21	.	-0.62	-0.82	-0.94	-0.60	73
2090	.	05/29/78	F K	1.43	0.38	.	0.20	-1.44	-2.07	-2.13	-1.93	74
2241	.	10/16/78	F K	1.6	0.8	-0.1	.	-0.8	-2.6	-2.4	-2.3	75
2243	.	09/25/78	NF UK	.	.	.	.	.	.	.	.	76
2245	.	09/20/78	NF UK	.	.	.	.	.	.	.	.	77
2251	.	10/17/78	F K	2.2	2.3	2.7	78
2254	.	09/25/78	F K	3.0	1.6	0.6	.	-0.1	-1.3	-1.5	-1.4	79
2255	.	10/14/78	NF UK	80

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11

GL/CRL	POSITION (1950)	DATE (UT)	SAUS CUMM	2.3	3.5	4.7	4.9	8.5	10.6	11.4	12.5	CRO
2256	.	05/29/78	NF UK	81
2259	.	09/24/78	F UK	6.09	2.79	0.60	.	-1.00	-1.55	-1.90	-1.71	82
2261	.	10/16/78	F K	0.6	0.5	0.9	.	0.6	0.4	0.6	0.6	83
2265	.	05/29/78	NF UK	.	.	.	.	.	.	.	.	84
2266	.	10/14/78	NF K	.	.	.	.	.	.	.	.	85
2267	.	09/20/78	IS SAU K	2.3	2.3	2.6	.	2.3	2.1	2.3	1.9	86
2270	.	09/24/78	F K	2.12	1.23	1.02	.	0.61	-0.42	-0.70	-0.54	87
2271	.	05/29/78	NF UK	.	.	.	.	.	.	.	.	88
2278	.	10/12/78	F K	-1.3	-1.4	-1.1	.	-1.3	-1.5	-1.7	-1.4	89
2294	.	10/12/78	NF K	.	.	.	.	.	.	.	.	90
2297	.	09/25/78	F UK NV	5.9	2.3	0.4	.	-1.0	-1.3	-1.6	-1.7	91
2299	.	10/14/78	F K	0.4	-0.3	-1.2	.	-2.5	-3.8	-3.6	-3.4	92
2290	18 56 04: 006 38 03 A	05/29/78	F UK	3.41	0.72	.	-0.72	-2.51	-2.79	-3.34	-3.44	93
2296	.	05/30/78	NF UK	.	.	.	.	.	.	.	.	94
2300	.	09/24/78	F K	1.64	0.96	0.86	.	0.34	-0.19	-0.25	-0.20	95
2303	.	05/30/78	NF UK	.	.	.	.	.	.	.	.	96
2304	.	10/14/78	NF K	.	.	.	.	.	.	.	.	97
2303	.	09/20/78	F UK	1.9	2.0	2.5	.	2.0	1.7	.	.	98
2441	.	05/30/78	NF UK	.	.	.	.	.	.	.	.	99
2441	.	10/14/78	F K	3.1	1.9	1.0	.	-0.1	-0.4	-0.4	-0.3	100
2422	.	05/13/79	F K	1.39	1.05	1.19	.	0.84	0.30	0.49	0.35	101
2427	.	05/30/78	NF UK	.	.	.	.	.	.	.	.	102
2474	19 53 46: 022 14 01 A	05/30/78	F UK	.	1.99	.	1.14	0.14	-0.31	-0.50	-0.40	103
2479	.	09/20/78	F K	0.6	-0.1	-0.6	.	-1.8	-2.6	-2.4	-2.3	104
2491	.	10/14/78	IS SAU K S1	2.2	2.3	2.2	.	2.2	2.6	2.4	.	105
2491	.	10/14/78	069240 K S2	.	.	.	.	.	.	.	.	106
2639	.	10/16/78	NF K	.	.	.	.	.	.	.	.	107
2645	.	09/25/78	F K	1.3	0.7	0.5	.	-0.1	-0.4	-0.6	-0.6	108
2670	.	09/25/78	NF UK	.	.	.	.	.	.	.	.	109
2726	.	09/21/78	F K	1.38	1.15	1.31	.	1.11	1.15	0.99	1.27	110
2818	.	09/21/78	F K	2.25	1.60	1.77	.	1.09	1.01	0.60	0.51	111
2819	.	09/20/78	164760 K	0.9	0.7	0.7	.	0.2	-0.6	-0.7	.	112
2828	.	09/21/78	090155 K	-0.39	-0.67	-0.47	.	-0.71	-1.04	-1.00	-1.04	113
2974	.	09/20/78	F K	1.5	1.4	1.6	.	1.0	0.1	0.5	0.9	114
2986	.	10/16/78	F K	0.64	0.62	0.60	.	.	.	.	.	115
2993	.	09/20/78	F K	4.8	4.9	.	.	.	.	.	.	116
3007	.	10/16/78	072919 K	.	.	.	.	.	.	.	.	117
3129	.	09/21/78	NF K	.	.	.	.	.	.	.	.	118
3139	.	09/24/78	NF K	.	.	.	.	.	.	.	.	119
3185	.	09/24/78	NF K	.	.	.	.	.	.	.	.	120

GL/CRL	POSITION (1950)	DATE (UT)	SAUS CUMM	2.3	3.5	4.7	4.9	8.5	10.6	11.0	12.5	CKD
3194	.	09/24/78	F K	0.80	0.29	0.08	.	-0.28	-0.69	-0.98	-0.73	121
4007	.	09/24/78	F K	2.59	2.40	2.46	.	2.70	2.02	.	.	122
4016	.	09/20/78	NF UK	.	.	.	.	.	.	.	.	123
4042	.	09/20/78	IS SAU K	2.2	2.3	2.5	.	1.9	.	.	.	124
4065	.	02/18/79	F K	1.12	0.80	0.52	.	0.10	-0.76	-0.74	-0.77	125
4079	.	02/17/79	NF UK	.	.	.	.	.	.	.	.	126
4138	11 52 03. +37 25 +2 I	05/31/78	F K	2.36	2.62	.	2.60	.	.	.	.	127
4141	.	02/14/79	F K	3.23	3.11	2.94	.	3.23	.	.	.	128
4164	.	05/27/78	NF UK	.	.	.	.	.	.	.	.	129
4198	.	05/30/78	F K	1.37	1.56	1.87	.	.	.	.	.	130
4198	.	02/10/79	F K	1.83	1.60	1.79	.	1.71	.	.	.	131
4219	15 46 30.7 +28 18 32 S	05/27/78	084015 K	.	2.95	.	1.63	0.06	.	-0.03	-0.10	132
4240	.	09/25/78	NF UK	.	.	.	.	.	.	.	.	133
4241	.	10/15/78	F K	1.9	1.4	0.9	.	0.12	-1.1	-0.8	-0.7	134
4242	.	09/24/78	NF UK	.	.	.	.	.	.	.	.	135
4255	.	05/30/78	NF UK	.	.	.	.	.	.	.	.	136
4269	.	09/25/78	F K	1.6	1.8	1.4	.	1.0	0.3	0.2	.	137
4306	.	09/21/78	F UK	.	4.08	3.46	.	2.90	.	.	.	138

THIS DOCUMENT CONTAINS UNCLASSIFIED INFORMATION.

APPENDIX B

This is a reprint of the paper published in the *Astronomical Journal*. It discusses the observations obtained with the downlooker system and is complete through May of 1978.

GROUND-BASED OBSERVATIONS OF SOURCES IN THE AFGL INFRARED SKY SURVEY

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ABSTRACT

We present a preliminary report on ground-based observations of sources discovered by the AFGL infrared sky survey. This paper contains photometric data on 104 sources and spectrophotometry ($\Delta\lambda/\lambda \approx 0.02$) of 14 sources identified in 6.0×4.5 -arcmin raster scans around the positions reported by the AFGL. The sources originally identified in the catalog with known objects are mainly hot, bright stars. Two unusual sources discovered in this program, GL 2636 and GL 4029, appear to be multiple sources. Both these objects exhibit the $3.3\text{-}\mu\text{m}$ emission feature, and GL 4029 shows several other emission features, previously found in NGC 7027.

I. INTRODUCTION

When the preliminary version of the AFGL infrared sky survey (Walker and Price 1975) was released in 1972, there was great hope that new classes of infrared objects would be discovered, especially among those sources not identified with normal stars. Subsequent ground-based observations, however, have shown that a majority of the sources not identified by Walker and Price are, in fact, late-type stars. Nevertheless, these observations (Cohen 1975; Cohen and Kuhl 1976, 1977; Lebofsky and Kleinmann 1976; Low *et al.* 1976; Merrill and Stein 1976; Gehrz and Hackwell 1976; Joyce *et al.* 1977; Lebofsky *et al.* 1978) have occasionally turned up remarkable objects.

Both to continue this search for new kinds of sources and to assess the catalog and its contents in an objective manner, we have initiated a systematic program of observations. These observations cover the fields of $\sim 1/3$ of the sources in the catalog (Price and Walker 1976), namely those lying between 40^{m} and 60^{m} of each hour of right ascension in declinations accessible from Mt. Lemmon, Arizona ($27^{\circ}26'09''$ N, $108^{\circ}09'08''$ W, $32^{\circ}26'21''$ N).

II. OBSERVATIONS

All observations reported here have been obtained at the UCSD/University of Minnesota $f/16$ 1.5-m telescope at Mt. Lemmon. The basic plan of the observations consisted of a standard raster scan of an error box centered on a catalog position. At the conclusion of the raster, any source discovered in the box was observed photometrically, and if the source proved interesting, narrow-band spectrometry was obtained. All classes of sources reported in the catalog have been included among the objects studied.

The standard raster pattern covered an area of 6.0 in hour angle, by 4.5 in declination, corresponding to a $\pm 2\sigma$ error box, where σ was determined from the systematic

positional errors reported in the AFGL survey. The telescope was first centered on an SAO star and slewed under digital control to the SW corner of the error box. Scanning then proceeded at a 0.7 s^{-1} scanning speed and with a $17''$ -diameter circular aperture. North-south chopping was used at frequencies of 10, 15, 20, and 30 Hz, and with a beam separation of $26''$. An east-west line separation of $9''$ guaranteed that a source would appear in two consecutive lines, with the characteristic S-shaped form caused by the chopping making identification straightforward on the strip-chart recording. Finally, upon completion of the scan, the telescope again was slewed digitally from the NE corner of the pattern to a second SAO star. This procedure served as a check that all of the offset calculations had been performed accurately and that the correct part of the sky had been scanned. Closure errors varied from observation to observation, but were required to be smaller than $36''$.

Two detector systems were employed during the observations: An InSb photovoltaic detector was used for scanning at $3.5\text{ }\mu\text{m}$, for obtaining $1.65\text{--}3.5\text{-}\mu\text{m}$ broadband photometric data, and for obtaining $2\text{--}4\text{-}\mu\text{m}$ spectrophotometric data. The second (long wavelength) system employed a Si(As) photoconductive detector, and was used for scanning both at 3.5 and $11.2\text{ }\mu\text{m}$, for obtaining $2.3\text{--}12.5\text{-}\mu\text{m}$ photometric data, and for obtaining $8\text{--}14\text{-}\mu\text{m}$ spectrometric data.

The detection limits during scanning at $3.5\text{ }\mu\text{m}$ were 7.0 and 5.0 mag for the InSb and Si(As) systems, respectively. At $11.2\text{ }\mu\text{m}$, the limit was 1.5 mag. Table 1 summarizes both the UCSD and the AFGL detection

TABLE 1 UCSD survey sensitivities compared to those of the AFGL

Wavelength (μm)	AFGL (mag)	UCSD (mag)
3.5		7 (5), InSb (Si As)
4.2	+1.3	
11	-1.1	1.5, Si As
19	-3.1	

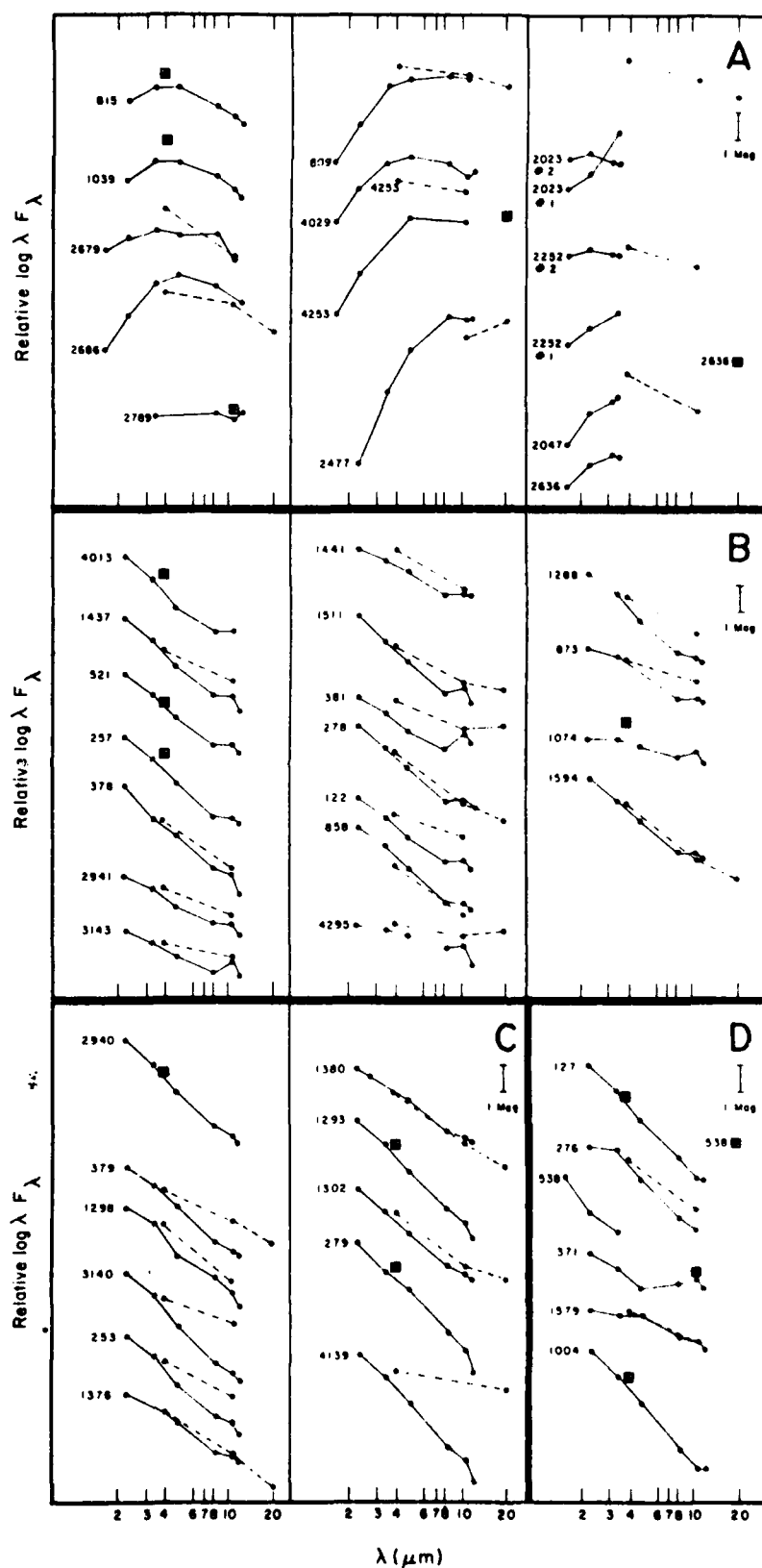


FIG. 1. Photometric data on sources in the AIGL infrared catalog. UCSD data are represented by solid lines, and AIGL data by dashed lines and squares. Only relative values are shown, with AIGL data plotted at correct level with respect to UCSD data for a particular object. Numerical details appear in Table 1. (a) Cool objects ($T < 1000$ K); (b) objects with strong silicate or SiC emission at $11.2 \mu\text{m}$; (c) weak emission at $11.2 \mu\text{m}$; (d) unusual objects.

TABLE II. Summary of observations.

GL#	POSITION (1950)	DATE (UT)	SAO#	CONN	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CRD
0105		10/12/76	NP	UK	.	.	.	.	.	.	.	.	1
0108	00 43 55.7 +15 12 12 S	12/06/76	092072	K	.	0.29	.	0.05	0.27	0.10	-0.03	-0.03	2
0111	00 46 05.1 +07 18 48 S	12/06/76	109474	K	.	0.89	.	0.66	0.88	0.83	0.66	0.80	3
0113	00 46 18.9 +56 48 10 S	11/20/76	021738	K	.	2.30	.	2.01	2.18	2.05	1.98	.	4
0115	.	10/15/76	NP	UK	.	.	.	.	.	.	.	.	5
0119	.	10/12/76	NP	OK	.	.	.	.	.	.	.	.	6
0120	00 49 01.8 +59 18 06 S	11/20/76	021779	K	.	1.91	.	1.58	1.73	1.58	1.46	.	7
0122	00 49 53.1 +47 08 16 V	12/05/76	F	K	.	2.21	.	1.62	1.43	0.75	-0.21	-0.12	8
0123	00 50 27.0 -01 24 56 S	12/06/76	129009	K	.	1.08	.	0.85	1.09	0.99	0.94	0.85	9
0124	.	10/15/76	NP	UK	.	.	.	.	.	.	.	.	10
0126	.	10/15/76	NP	UK	.	.	.	.	.	.	.	.	11
0127	00 52 14.0 +48 24 29 S	12/10/76	036763	K	.	1.77	.	1.54	0.69	0.27	-0.38	-0.18	12
0129	00 52 33.8 +24 17 12 S	12/06/76	074365	K	.	1.13	.	0.87	1.10	0.91	0.77	0.83	13
0132	00 53 13.8 +57 43 35 S	12/08/76	021846	K	.	3.01	.	2.88	3.04	3.06	3.03	3.49	14
0143	00 58 07.2 -01 55 40 S	12/06/76	127076	K	.	1.67	.	1.42	1.64	1.48	1.35	1.34	15
0144	.	10/15/76	NP	UK	.	.	.	.	.	.	.	.	16
0145	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	17
0250	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	18
0253	01 47 14.1 +53 29 43 S	12/10/76	022663	K	.	0.88	.	0.54	0.69	0.27	-0.38	-0.18	19
0256	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	20
0257	01 50 33.1 +53 59 19 I	12/08/76	F	K	.	2.28	.	1.98	2.02	1.64	0.79	0.68	21
0262	01 51 41.1 +08 32 10 I	10/16/76	F	K	2.18	1.99	.	1.85	.	.	.	.	22
0262	.	11/18/76	F	K	.	2.06	.	1.86	2.17	1.84	1.62	.	23
0274	01 54 52.9 +27 33 43 S	10/16/76	075048	K	1.71	1.50	.	1.33	.	.	.	.	24
0274	.	11/18/76	075048	K	.	1.51	.	1.29	1.64	1.33	1.33	.	25
0276	01 55 10.7 +38 53 31 S	10/16/76	055147	K	.	0.33	.	0.44	.	.	.	.	26
0276	.	11/20/76	055147	K	.	1.00	.	-0.09	0.10	-0.01	-0.16	.	27
0278	01 55 37.3 +45 11 32 S	12/05/76	037673	K	.	-0.98	.	-1.35	-1.41	-1.88	-2.76	-2.80	28
0279	01 50 11.7 -07 54 32 S	12/11/76	129546	K	.	2.15	.	2.17	1.88	1.86	1.75	2.37	29
0280	01 56 14.8 +54 34 49 S	12/08/76	022817	K	.	1.07	.	0.61	0.38	-0.06	-0.49	-0.57	30
0371	02 40 44.1 +36 02 13 V	12/05/76	F	K	.	2.89	.	2.38	2.20	0.32	-0.79	-0.60	31
0377	02 44 55.5 +29 02 27 S	12/05/76	075578	K	.	2.04	.	1.90	2.02	1.94	1.83	1.94	32
0378	02 45 32.1 -12 40 04 S	12/11/76	148612	K	.	0.34	.	0.47	0.08	-0.14	-0.75	-0.23	33
0379	02 45 32.0 +17 18 07 S	12/06/76	093115	K	.	0.33	.	-0.10	-0.16	-0.49	-0.94	-1.10	34
0381	02 46 55.3 +56 46 38 S	12/08/76	023647	K	.	2.10	.	1.48	1.24	0.31	-1.26	-1.21	35
0387	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	36
0387	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	37
0409	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	38
0412	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	39
0416	.	10/25/77	F	K	11.38	9.88	.	.	.	.	.	.	40
0416	.	10/28/77	F	K	.	.	.	10.41	.	.	3.82	.	41
0443	.	12/08/76	NP	UK	.	.	.	.	.	.	.	.	42
0512	03 40 31.9 +12 18 11 S	12/06/76	091566	K	.	1.12	.	0.79	0.97	0.74	0.53	0.48	43
0519	03 43 46.5 -12 15 26 S	12/06/76	149158	K	.	0.37	.	0.13	0.27	0.16	0.07	0.08	44
0521	03 44 56.8 +50 41 12 S	12/08/76	024237	K	.	1.86	.	1.48	1.43	0.85	-0.11	0.02	45
0522	03 45 52.1 +50 54 12 V	12/08/76	F	K	.	2.72	.	1.99	1.72	1.30	0.82	0.61	46
0525	03 46 20.8 -07 10 00 S	12/06/76	130743	K	.	0.88	.	0.57	0.64	0.42	0.10	-0.02	47
0510	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	48
0518	03 58 00.5 +56 56 20 U	10/12/76	F	UK	5.25	5.80	.	5.45	.	.	.	.	49
0518	.	11/20/76	NP	UK	.	.	.	.	.	.	.	.	50
0621	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	51
0622	04 40 59.1 +20 40 14 I	12/06/76	F	K	.	2.17	.	1.71	1.57	1.26	0.78	0.72	52
0624	04 40 34.0 +32 46 24 S	12/05/76	057393	K	.	0.97	.	0.68	0.65	0.61	0.56	0.53	53
0634	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	54
0635	04 46 32.4 +37 24 07 S	12/05/76	057447	K	.	1.53	.	1.26	1.33	1.31	1.21	1.32	55
0637	04 48 23.1 +28 26 16 V	12/05/76	F	K	.	1.17	.	0.63	0.76	0.26	0.02	0.04	56
0645	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	57
0647	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	58
0650	.	10/11/76	NP	UK	.	.	.	.	.	.	.	.	59
0649	.	10/16/76	NP	UK	.	.	.	.	.	.	.	.	60
0671	04 54 57.1 +60 23 18 B	12/07/76	F	K	.	2.15	.	1.97	1.90	1.84	1.87	2.11	61
0674	04 58 59.1 +41 01 18 R	12/07/76	F	K	.	0.22	.	-0.05	0.09	0.00	-0.04	-0.02	62
0804	05 40 33.1 +32 40 58 II	10/11/76	F	UK	5.6A	3.3A	.	0.8A	.	.	.	.	63
0804	.	10/16/76	F	UK	6.63	4.17	.	1.67	.	.	.	.	64
0804	.	11/14/76	F	UK	.	4.46	.	1.67	0.33	-1.50	-2.10	.	65
0812	05 42 01.7 +24 24 01 S	12/05/76	077502	K	.	1.83	.	1.11	1.23	0.38	0.06	0.00	66
0815	05 44 09.1 +43 11 16 I	12/07/76	F	K	.	3.23	.	1.47	0.44	-0.48	-0.96	-0.95	67
0815	.	12/15/76	F	K	NB	3.23	.	1.44	0.47	-0.44	-0.96	-0.95	68
0818	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	69
0819	05 44 55.5 -12 49 18 S	12/10/76	150408	K	.	1.61	.	1.29	1.47	1.35	1.13	1.18	70
0821	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	71
0823	.	01/10/77	NP	K	.	.	.	.	.	.	.	.	72
0845	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	73
0847	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	74
0856	05 54 51.1 +10 54 18 V	12/06/76	F	K	.	1.33	.	0.87	0.70	0.37	-0.06	-0.26	75
0857	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	76
0858	05 59 16.1 -02 21 12 V	12/06/76	F	K	.	-0.08	.	-0.43	-0.47	-0.81	-1.65	-1.59	77
0860	.	10/12/76	NP	UK	.	.	.	.	.	.	.	.	78
0862	05 59 47.3 +50 16 53 S	12/08/76	025540	K	.	2.41	.	2.05	2.20	2.03	1.99	1.91	79
0873	06 03 51.1 -05 42 14 I	02/03/77	F	K	.	2.67	.	11.73	1.17	0.75	-0.15	-0.29	80

GL#	POSITION (1950)	DATE (UT)	SOURCE	COMM	1.65	2.28	3.2	4.5	4.9	8.4	11.2	12.5	CRD
0873	.	02/21/78	F	K	NV	11.44	8.71	.	5.00	.	.	.	H1
0998	.	12/07/76	NP	K	.	.	.	.	.	.	.	.	H2
1001	06 40 51.4 +25 10 57 S	12/05/76	078682	K	.	0.24	.	0.02	0.17	-0.07	0.02	0.04	H3
1002	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	H4
1004	06 41 35.4 +29 01 24 S	12/05/76	078692	K	.	2.12	.	1.94	2.03	2.03	1.88	1.65	H5
1005	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	H6
1006	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	H7
1011	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	H8
1013	.	11/18/76	NP	UK	.	.	.	.	.	.	.	.	H9
1015	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	90
1018	.	11/18/76	NP	UK	.	.	.	.	.	.	.	.	91
1019	.	12/10/76	NP	UK	.	.	.	.	.	.	.	.	92
1020	.	11/18/76	NP	UK	.	.	.	.	.	.	.	.	93
1023	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	94
1024	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	95
1026	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	96
1027	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	97
1029	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	98
1031	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	99
1031	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	100
1032	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	101
1033	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	102
1039	.	02/06/77	NP	UK	.	.	.	.	.	.	.	.	103
1039	06 53 09.7 -02 16 18 U	02/07/77	F	OK	.	4.37	.	2.46	1.46	0.31	-0.03	0.05	104
1046	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	105
1048	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	106
1049	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	107
1054	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	108
1074	07 05 26. -10 39 .5 I	02/03/77	F	K	.	1.71	.	2.43	1.73	0.42	-0.42	-0.52	109
1131	07 27 01. -19 21 .4 I	02/03/77	F	K	.	2.08	.	0.81	0.20	-0.82	-1.33	-1.25	110
1180	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	111
1182	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	112
1188	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	113
1188	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	114
1189	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	115
1191	07 44 17.1 +33 32 25 S	02/12/77	060340	K	.	1.20	.	0.97	1.04	0.94	0.87	0.84	116
1192	.	02/08/77	NP	K	.	.	.	.	.	.	.	.	117
1193	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	118
1194	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	119
1197	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	120
1216	07 58 40.7 -01 15 09 S	12/06/76	135380	K	.	1.23	.	1.03	1.09	0.99	1.00	0.98	121
1218	07 59 39.9 +02 28 24 S	12/06/76	116260	K	.	1.51	.	1.29	1.31	1.23	1.31	1.20	122
1285	08 41 50.7 +18 20 22 S	12/05/76	098087	K	.	1.53	.	1.39	1.42	1.31	1.46	1.44	123
1288	08 43 46.0 +01 48 57 S	12/06/76	117103	K	.	0.24	.	-0.11	-0.08	-0.51	-1.22	-1.31	124
1289	08 44 07.8 +06 36 12 S	12/06/76	117112	K	.	1.57	.	1.47	1.41	1.32	1.41	1.31	125
1290	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	126
1292	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	127
1293	08 45 54.7 +12 43 58 S	12/05/76	098143	K	.	1.91	.	1.67	1.85	1.65	1.44	1.68	128
1295	.	12/05/76	NP	UK	.	.	.	.	.	.	.	.	129
1297	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	130
1298	08 52 34.0 +17 25 22 S	02/12/77	098230	K	.	0.39	.	-0.14	0.08	-0.67	-0.87	-0.83	131
1301	08 53 48.9 +20 02 30 S	02/06/77	080524	K	.	1.03	.	0.25	0.17	-0.61	-0.75	-0.61	132
1302	08 55 33.1 +11 02 23 S	02/08/77	098266	K	.	0.25	.	-0.04	-0.05	-0.39	-0.88	-0.93	133
1305	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	134
1372	09 41 00.6 +14 15 05 S	12/08/76	098733	K	.	1.20	.	0.96	1.09	0.97	0.95	0.96	135
1373	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	136
1375	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	137
1376	09 42 34.7 +34 44 34 S	12/05/76	061669	K	.	-0.21	.	-0.97	-1.43	-1.95	-2.72	-2.84	138
1377	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	139
1378	09 43 00.1 +57 21 32 S	12/08/76	027377	K	.	0.33	.	0.02	0.15	0.03	-0.03	-0.02	140
1379	09 43 31.8 +06 56 25 S	12/06/76	117898	K	.	1.67	.	1.46	1.62	1.46	1.35	1.31	141
1380	09 44 52.2 +11 39 42 S	12/05/76	098769	K	.	-2.47	.	-3.09	-3.36	-3.80	-4.41	-4.57	142
1382	.	12/06/76	NP	UK	.	.	.	.	.	.	.	.	143
1383	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	144
1384	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	145
1385	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	146
1387	09 51 05.4 +06 11 41 S	03/12/77	117975	K	1.48	1.47	1.18	1.05	.	.	.	.	147
1390	.	03/10/77	NP	UK	.	.	.	.	.	.	.	.	148
1391	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	149
1392	.	12/07/76	NP	UK	.	.	.	.	.	.	.	.	150
1437	10 46 10. +08 55 .8 V	02/08/77	F	K	.	1.82	.	1.47	1.34	0.91	0.11	0.13	151
1441	10 50 59. +13 58 .9 V	02/08/77	F	K	.	2.61	.	1.85	1.26	0.62	-0.36	-0.17	152
1444	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	153
1446	10 53 25.7 +06 27 09 S	02/08/77	118576	K	.	-0.71	.	-0.95	-0.89	-1.00	-1.16	-1.19	154
1453	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	155
1507	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	156
1509	11 43 17.3 +06 48 35 S	05/31/78	119035	K	.	0.10	.	0.03	0.21	.	.	.	157
1510	11 43 25.0 +48 03 24 S	05/31/78	043886	K	.	1.06	.	0.91	1.02	.	.	.	158
1511	11 44 36.1 +43 44 57 S	02/08/77	043889	K	.	0.98	.	0.62	0.43	0.06	-0.98	-1.04	159
1514	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	160
1518	.	02/07/77	NP	UK	.	.	.	.	.	.	.	.	161
1520	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	162
1522	.	02/08/77	NP	UK	.	.	.	.	.	.	.	.	163
1523	.	06/10/76	NP	UK	.	.	.	.	.	.	.	.	164

GLP	POSITION (1950)	DATE (UT)	SOURCE	COORD	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CRD
1524	.	02/08/77	NP UK	.	.	.	.	.	.	.	.	.	165
1528	.	02/06/77	NP UK	.	.	.	.	.	.	.	.	.	166
1529	.	02/06/77	NP UK	.	.	.	.	.	.	.	.	.	167
1530	.	06/09/76	NP UK	.	.	.	.	.	.	.	.	.	168
1573	.	02/06/77	NP UK	.	.	.	.	.	.	.	.	.	169
1574	.	02/08/77	NP UK	.	.	.	.	.	.	.	.	.	170
1575	.	02/07/77	NP UK	.	.	.	.	.	.	.	.	.	171
1576	12 42 47. +45 42 .8 V	06/07/76	F K	.	.	.	.	.	.	.	.	.	172
1577	.	02/07/77	NP UK	.	.	.	.	.	.	.	.	.	173
1578	.	02/07/77	NP UK	.	.	.	.	.	.	.	.	.	174
1579	12 44 46. +04 25 .1 V	02/12/77	F K	.	1.81	.	0.74	-0.20	-1.11	-1.78	-1.70	.	175
1580	.	03/10/77	NP UK	.	.	.	.	.	.	.	.	.	176
1582	.	02/07/77	NP UK	.	.	.	.	.	.	.	.	.	177
1583	12 51 45. -09 16 B	05/31/78	F K	.	0.52	.	0.26	0.57	.	.	.	.	178
1587	.	02/08/77	NP UK	.	.	.	.	.	.	.	.	.	179
1590	.	02/08/77	NP UK	.	.	.	.	.	.	.	.	.	180
1594	13 00 06. +05 27 .2 V	02/12/77	F K	.	-0.99	.	-1.37	-1.55	-1.95	-2.79	-2.90	.	181
1644	.	03/12/77	NP UK	.	.	.	.	.	.	.	.	.	182
1645	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	183
1646	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	184
1647	.	06/10/76	NP UK	.	.	.	.	.	.	.	.	.	185
1649	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	186
1655	.	02/22/78	NP UK	.	.	.	.	.	.	.	.	.	187
1657	.	02/22/78	NP UK	.	.	.	.	.	.	.	.	.	188
1659	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	189
1660	13 52 29.9 -26 11 13 S	05/30/78	182081 K	.	1.75	.	1.31	1.36	0.97	.	0.32	.	190
1662	.	03/12/77	NP UK	.	.	.	.	.	.	.	.	.	191
1664	.	06/10/76	NP UK	.	.	.	.	.	.	.	.	.	192
1665	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	193
1667	.	02/22/78	NP UK	.	.	.	.	.	.	.	.	.	194
1668	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	195
1671	13 58 16.7 +39 16 17 S	06/11/76	06J881 UK	3.86	3.73	3.62	3.62	.	.	.	.	.	196
1672	.	03/12/77	NP UK	.	.	.	.	.	.	.	.	.	197
1674	.	02/22/78	NP UK	.	.	.	.	.	.	.	.	.	198
1723	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	199
1725	.	06/07/76	NP UK EO	.	.	.	.	.	.	.	.	.	200
1727	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	201
1724	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	202
1730	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	.	203
1731	.	06/11/76	NP UK	.	.	.	.	.	.	.	.	.	204
1735	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	205
1737	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	206
1738	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	207
1739	.	06/10/76	NP UK	.	.	.	.	.	.	.	.	.	208
1742	.	02/22/78	NP UK	.	.	.	.	.	.	.	.	.	209
1743	14 55 02.6 -12 14 15 S	05/30/78	158929 K	.	0.40	.	-0.07	0.04	-0.37	.	-1.01	.	210
1795	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	.	211
1801	15 48 23.2 +15 17 02 S	05/30/78	101771 K	.	0.48	.	-0.31	-0.55	-0.96	.	-1.76	.	212
1802	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	213
1808	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	214
1812	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	.	215
1813	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	216
1815	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	217
1884	.	06/07/76	NP UK EO	.	.	.	.	.	.	.	.	.	218
1897	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	219
1901	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	220
1902	.	06/12/76	NP UK EO	.	.	.	.	.	.	.	.	.	221
1922	17 04 53. -24 39 .0 A	06/07/76	F UK	.	.	.	.	.	.	.	.	.	222
2009	.	06/07/76	F UK EO	.	.	.	.	.	.	.	.	.	223
2009	17 45 45.5 -28 53 00 S	06/09/76	185788 UK	5.09	4.86	4.65	4.69	.	.	.	.	.	224
2009	.	06/10/76	185788 UK NB	5.23	5.08	4.97	4.88	.	.	.	.	.	225
2009	.	06/11/76	185788 UK NB	5.15	4.94	5.08	4.67	.	.	.	.	.	226
2015	17 47 29. -27 51 .2 A	06/07/76	F UK	.	.	.	.	.	.	.	.	.	227
2022	.	06/12/76	NP UK	.	.	.	.	.	.	.	.	.	228
2023	17 51 15. -25 47 .3 A	06/07/76	F UK	.	.	.	.	.	.	.	.	.	229
2023	.	06/12/76	F UK S1	8.1A	6.6A	.	3.5A	.	.	.	.	.	230
2023	.	06/12/76	F UK S2	6.8A	5.6A	5.1A	4.9A	.	.	.	.	.	231
2047	17 57 59.3 -17 44 34 U	06/07/76	F UK NV	.	.	.	.	.	.	.	.	.	232
2047	.	06/09/76	F UK NV	6.59	4.51	2.92	2.51	.	.	.	.	.	233
2047	.	06/10/76	F NB NV	6.71	4.65	3.04	2.53	.	.	.	.	.	234
2047	.	10/03/77	F UK	.	.	.	.	.	.	.	.	.	235
2051	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	236
2242	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	.	237
2249	.	06/08/76	NP UK	.	.	.	.	.	.	.	.	.	238
2252	18 45 03. -09 21 .6 A	06/07/76	F UK S1	.	.	.	.	.	.	.	.	.	239
2252	.	06/11/76	F UK S1	7.72	6.08	.	4.21	.	.	.	.	.	240
2252	.	06/12/76	F S1 NB	.	6.19	.	.	.	.	.	.	.	241
2252	18 45 03.7 -09 22 45 U	06/07/76	F UK S2	.	.	.	.	.	.	.	.	.	242
2252	.	06/09/76	F UK S2	3.98	2.84	2.16	1.81	.	.	.	.	.	243
2252	.	06/09/76	F UK S2	.	.	2.07	.	.	.	.	.	.	244
2252	.	06/10/76	F S2 NB	4.06	3.05	2.12	1.89	.	.	.	.	.	245
2253	.	06/09/76	NP UK	.	.	.	.	.	.	.	.	.	246
2256	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	.	247

GL0	POSITION (1950)	DATE (UT)	SAOB CORR	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CRD
2265	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	248
2271	.	05/29/78	NP UK	.	.	.	.	.	.	.	.	249
2277	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	250
2290	18 56 04. +06 38 .3 A	05/29/78	P UK	.	4.15	.	0.72	-0.72	-2.51	.	-3.44	251
2298	.	05/30/78	NP UK	.	.	.	.	.	.	.	.	252
2303	.	05/30/78	NP UK	.	.	.	.	.	.	.	.	253
2438	.	11/19/76	NP UK	.	.	.	.	.	.	.	.	254
2441	.	02/30/78	NP UK	.	.	.	.	.	.	.	.	255
2442	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	256
2445	19 42 21. +35 07 .9 P	06/07/76	P UK	.	.	.	.	.	.	.	.	257
2445	.	10/03/77	P UK	.	.	.	.	.	.	.	.	258
2448	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	259
2455	.	06/08/76	NP UK	.	.	.	.	.	.	.	.	260
2455	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	261
2457	.	05/30/78	NP UK	.	.	.	.	.	.	.	.	262
2470	.	06/07/76	NP UK	.	.	.	.	.	.	.	.	263
2474	19 53 46. +22 14 .1 A	05/30/78	P UK	.	2.93	.	1.99	1.14	0.14	.	-0.40	264
2477	19 54 50.0 +30 35 57 U	12/10/76	P UK	.	8.66	.	4.61	1.87	-1.23	-1.97	-2.23	265
2478	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	266
2481	.	06/07/76	P K	.	.	.	.	.	.	.	.	267
2481	19 55 55.0 -03 41 24 S	06/11/76	143959 K	2.25	2.03	1.89	1.84	.	.	.	.	268
2489	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	269
2492	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	270
2494	19 59 21. +40 45 .7 P	06/07/76	P UK	.	.	.	.	.	.	.	.	271
2494	.	10/03/77	P UK	.	.	.	.	.	.	.	.	272
2636	20 40 47.0 +42 45 52 U	06/11/76	P UK NV	8.76	6.97	5.61	5.34	.	.	.	.	273
2636	.	06/12/76	P NV NB	.	7.07	.	.	.	.	.	.	274
2636	.	11/20/76	NP UK	.	.	.	.	.	.	.	.	275
2636	.	12/11/76	P UK	.	.	.	.	.	.	.	2.63	276
2636	.	12/11/76	P UK	.	.	.	6.69	5.72	2.99	2.56	2.24	277
2636	.	10/03/77	P UK	8.95	7.18	.	5.53	.	.	.	.	278
2638	.	06/07/76	NP UK EO	.	.	.	.	.	.	.	.	279
2669	.	12/10/76	NP UK	.	.	.	.	.	.	.	.	280
2679	20 54 55.8 +37 13 35 U	10/11/76	P UK NB	.	.	.	.	.	.	.	.	281
2679	.	10/16/76	P UK NB	5.17	3.73	.	2.25	.	.	.	.	282
2679	.	11/18/76	P UK	.	3.67	.	2.12	1.34	0.40	-0.12	.	283
2681	.	06/08/76	NP UK	.	.	.	.	.	.	.	.	284
2686	20 57 00.7 +27 14 42 U	10/11/76	P UK	5.51	3.00	.	0.51	.	.	.	.	285
2686	.	11/18/76	P UK	.	2.93	.	0.36	0.84	-2.24	3.04	.	286
2789	21 38 12. +50 00 .8 V	12/16/76	P K NB	.	.	.	2.45	.	-0.39	-0.94	-1.46	287
2789	.	10/24/77	P K	7.15	4.81	.	.	.	.	.	.	288
2824	.	06/08/76	NP UK	.	.	.	.	.	.	.	.	289
2932	22 38 34. +49 45 .6 V	10/12/76	P UK	2.26	.	.	.	.	.	.	.	290
2932	22 38 34. +49 45 .6 V	11/18/76	P K	.	1.64	.	1.32	1.34	0.93	-0.04	.	291
2939	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	292
2940	22 40 37.0 +27 53 42 S	12/05/76	090732 K	.	1.19	.	0.89	1.02	0.77	0.24	0.36	293
2941	22 41 16. +59 29 .5 I	12/10/76	P K	.	2.24	.	1.48	1.14	0.14	-0.64	-0.51	294
2944	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	295
2954	.	12/10/76	NP UK	.	.	.	.	.	.	.	.	296
2961	.	12/10/76	NP UK	.	.	.	.	.	.	.	.	297
2999	.	10/15/76	NP UK	.	.	.	.	.	.	.	.	298
3008	.	10/15/76	NP UK	.	.	.	.	.	.	.	.	299
3139	.	10/15/76	NP UK	.	.	.	.	.	.	.	.	300
3140	23 43 32.9 +46 08 34 S	12/05/76	053355 K	.	1.88	.	1.55	1.78	1.62	1.26	1.16	301
3143	23 42 32. +43 38 .8 V	12/10/76	P K	.	2.30	.	1.48	1.07	0.01	-1.19	-1.01	302
3144	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	303
3144	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	304
3151	.	10/16/76	NP UK	.	.	.	.	.	.	.	.	305
3178	.	12/11/76	NP UK	.	.	.	.	.	.	.	.	306
3196	23 58 41.9 +60 04 37 S	12/10/76	021002 K	.	0.54	.	0.23	0.36	0.00	-0.16	-0.03	307
4009	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	308
4010	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	309
4012	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	310
4013	01 52 47.6 +16 56 41 S	10/16/76	092697 K	2.20	1.90	.	1.93	.	.	.	.	311
4013	.	11/18/76	092697 K	.	1.91	.	1.61	1.70	0.90	0.00	.	312
4029	02 57 32.5 +60 17 22 U	10/12/76	P K	9.36	6.87	.	4.88	.	.	.	.	313
4029	.	10/15/76	P K NB	9.58	7.22	.	.	.	.	.	.	314
4029	.	11/18/76	NP K	.	.	.	.	.	.	.	.	315
4029	.	11/20/76	NP K	.	.	.	.	.	.	.	.	316
4029	.	12/16/76	P K NB	.	6.96	.	4.76	3.47	1.94	1.61	1.09	317
4029	.	10/03/77	P K	.	.	.	.	.	.	.	.	318
4029	.	10/24/77	P K	10.06	9.01	.	.	.	.	.	.	319
4029	.	10/25/77	P K	9.37	6.92	.	.	.	.	.	.	320
4029	.	10/25/77	P K	.	4.05	.	.	.	.	.	.	321
4029	.	10/26/77	P K	.	.	.	.	.	.	.	.	322
4029	.	10/26/77	F K	.	8.84	.	7.02	6.54	2.34	2.12	1.76	323
4036	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	324
4038	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	325
4040	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	326
4041	.	10/11/76	NP UK	.	.	.	.	.	.	.	.	327
4040	.	02/04/77	NP UK EO	.	.	.	.	.	.	.	.	328
4049	.	12/10/76	NP UK	.	.	.	.	.	.	.	.	329
4138	11 52 01. +17 45 .2 I	05/11/78	P K	.	2.96	.	2.77	2.70	.	.	.	330

GL#	POSITION (1950)	DATE (UT)	SAO#	COM	1.65	2.28	3.2	3.5	4.9	8.4	11.2	12.5	CRD
4139	11 52 39.3 +37 02 37 S	02/08/77	062754	K	.	2.17	.	1.93	1.98	1.69	1.72	1.87	331
4166	.	02/22/78	NP	UK	.	.	.	.	.	.	.	.	332
4184	.	02/21/78	NP	UK	.	.	.	.	.	.	.	.	333
4184	.	05/27/78	NP	OK	.	.	.	.	.	.	.	.	334
4219	15 46 30.7 +28 18 32 S	05/27/78	084015	K	.	4.21	.	2.95	1.63	0.06	.	-0.10	335
4253	19 45 31.7 +09 20 39 U	10/16/76	F	UK	9.42	7.04	.	4.17	.	.	.	.	336
4253	.	11/20/76	F	UK	.	6.62	.	.	2.5A	.	0.1A	.	337
4254	.	10/16/76	NP	UK	.	.	.	.	.	.	.	.	338
4255	.	05/30/78	NP	UK	.	.	.	.	.	.	.	.	339
4257	.	10/16/76	NP	UK	.	.	.	.	.	.	.	.	340
4257	.	11/20/76	NP	UK	.	.	.	.	.	.	.	.	341
4295	22 59 37. +10 20 .0 I	12/11/76	F	K	.	3.04	.	1.98	1.18	-0.04	-0.95	-0.53	342

Position codes (sources of quoted positions)

A	AFGL (no finding chart available) ($\alpha \pm 3'$, $\delta \pm 2'$).
B	<i>Catalogue of Bright Stars</i> (Schlesinger and Jenkins 1940) ($\alpha \pm 1'$, $\delta \pm 1'$).
I	AFGL (see finding chart, Fig. 5) ($\alpha \pm 3'$, $\delta \pm 2'$).
I	Two-micron sky survey (IRC) (Neugebauer and Leighton (1969) ($\alpha \pm 1'$, $\delta \pm 3'$).
S	SAO star catalog (SAO 1966) ($\alpha \pm 0.5''$, $\delta \pm 0.5''$).
U	Univ. California, San Diego (positions measured from Palomar Sky Survey plates, see also finding charts in Figs. 4 and 5) ($\alpha \pm 10''$, $\delta \pm 10''$).
V	<i>General catalog of variable stars</i> (Kukarkin et al. 1969) ($\alpha \pm 1'$, $\delta \pm 1'$).

Comment codes

K	Known or identified source (ID given by AFGL).
UK	Unknown or unidentified source (no ID given by AFGL).
EO	Extended object (with respect to AFGL beam size).
NV	Not visible (in Mt. Lemmon 1.5 m).
SI	Source No. 1, etc. (if more than one in error box).
NE	Not found in standard error box.
I	Found in error box.
NB	Narrow-band observations taken.
A	Following magnitudes, indicates an approximate value.

Note: GL 2474 does not appear in the GL Catalog, and therefore is more appropriately identified as CR1 2474.

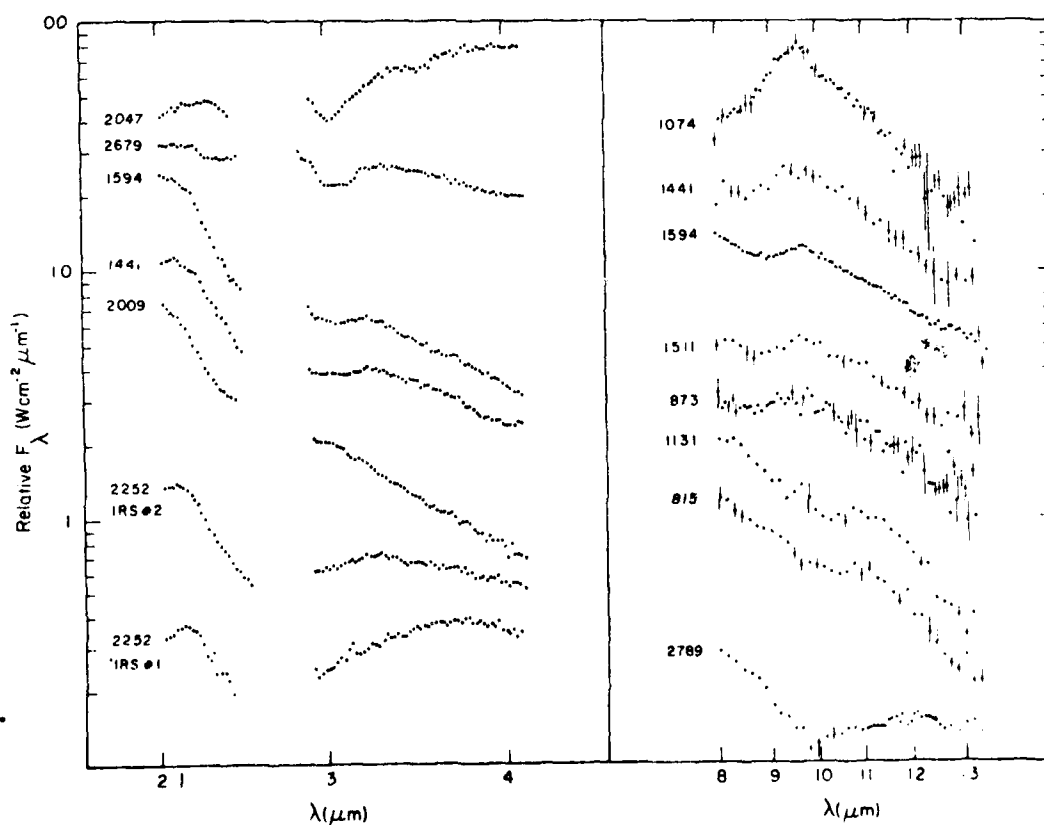


FIG. 2. 2.4- and 8-14- μ m spectrophotometry plotted by channel, with indicated wavelengths intended only as a rough guide. The data have been multiplied by the following factors for each object: 2047, 8.47 \times ; 1074, 3.65 \times ; 2679, 2.46 \times ; 1441, 1.16 \times ; 1594, 7.61 \times ; 1594, 8.28 \times ; 1441, 2.36 \times ; 1511, 2.88 \times ; 2009, 1.28 \times ; 873, 2.24 \times ; 2252, 4.69 \times ; 1131, 4.30 \times ; 2252, 2.14 \times ; 815, 4.47 \times .

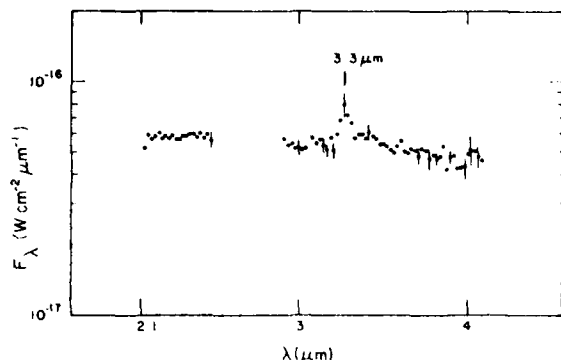


FIG. 3. The 2-4- μ m narrow-band spectrum of GL 2636 plotted by channel, with indicated wavelengths intended only as a rough guide. The feature at 3.3 μ m, originally discovered in the planetary nebula NGC 7027 (Merrill, Soifer, and Russell 1975), occurs in a limited class of infrared sources.

limits, where the latter were taken at the AFGL's claimed levels of statistical completeness. Although some fainter objects are listed in the catalog, the AFGL detection limit at 11 μ m suggests that for an object detected by the AFGL at 11 μ m, and with a blackbody spectrum warmer than 320 K, a detection at 3.5 μ m with the InSb system would be more likely than a detection at 11.2 μ m. Correspondingly, for a scan at 3.5 μ m with the Si(As) system, the limiting blackbody temperature would be 410 K.

III. DISCUSSION

Table II presents complete results to date for the broad-band photometry. Some of these data also appear in Fig. 1, with the remaining data either insufficient for classification or showing featureless zero-color ($K - N = 0.0$) stars. Figure 1(a) shows those objects having 2.3-12.5- μ m color temperatures < 1000 K. Some of these spectra show a small depression at 5 μ m likely to be due to CO, or emission or absorption at 11.2 μ m likely to be due to SiC or silicates. Figures 1(b) and 1(c) show those objects classified as relatively warm ($T > 1000$ K) and as having silicate or SiC emission. The strengths of the features in Fig. 1(b) were judged to be stronger than those of Fig. 1(c). Finally, Fig. 1(d) shows objects with unusual characteristics, subject to confirming measurements. In particular, GL 371 apparently shows a remarkable absorption feature in the region of 5 μ m.

From the broad-band photometry, we infer that sources 276, 416, 538, and 2636 may be multiple sources. For 276 and 416, this results from discrepancies in the photometry in Table I. For 538 and 2636, Fig. 1 shows striking discrepancies between AFGL data and UCSD data, which also may be due to the large aperture (3.4) used by the AFGL and the possible extended nature of these sources. K. M. Merrill (1978, private communication), however, has confirmed the multiple nature of 2636. GL 2023, 2252, and 4029 were found to be multiple sources by direct recordings during the raster scans, with individual sources to be hereafter designated as Nos.

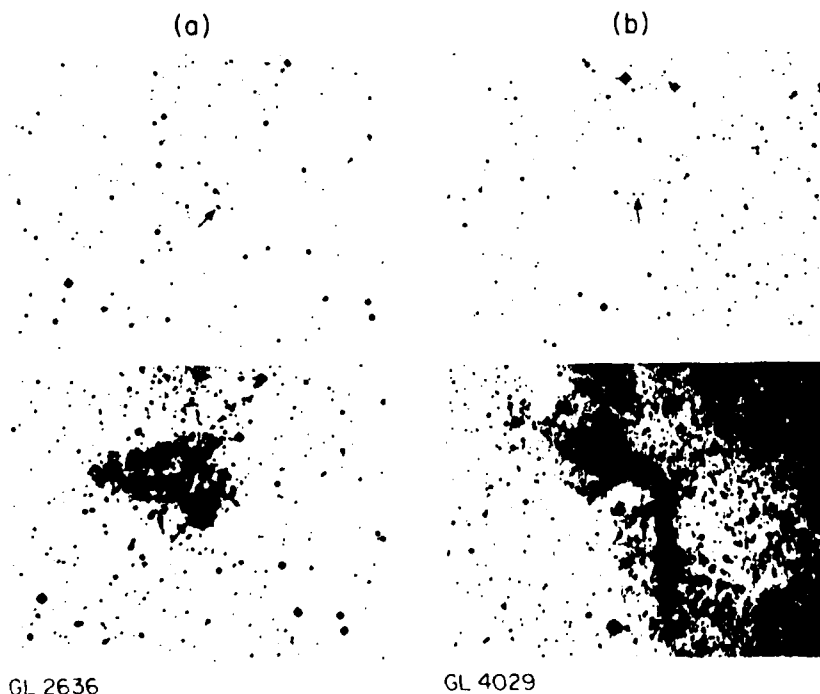


FIG. 4. (a) O (top) and I-Palomar sky survey plates (north is up) for GL 2636. B supergiant is indicated, and the near-infrared source is situated 15" W and 15" N of that location. 1950 coordinates for the infrared source are $\alpha = 20^{\text{h}}40^{\text{m}}47^{\text{s}}.0 (\pm 10'')$, $\delta = +42^{\circ}45'52'' (\pm 10'')$. Fields are $17' \times 13'$. (b) O (top) and I-Palomar sky survey plates (north is up) for GL 4029. An infrared source is indicated between what are apparently reflection nebulae. 1950 coordinates are $\alpha = 02^{\text{h}}57^{\text{m}}32^{\text{s}}.5 (\pm 10'')$, $\delta = +60^{\circ}17'22'' (\pm 10'')$. Fields are $17' \times 13'$.

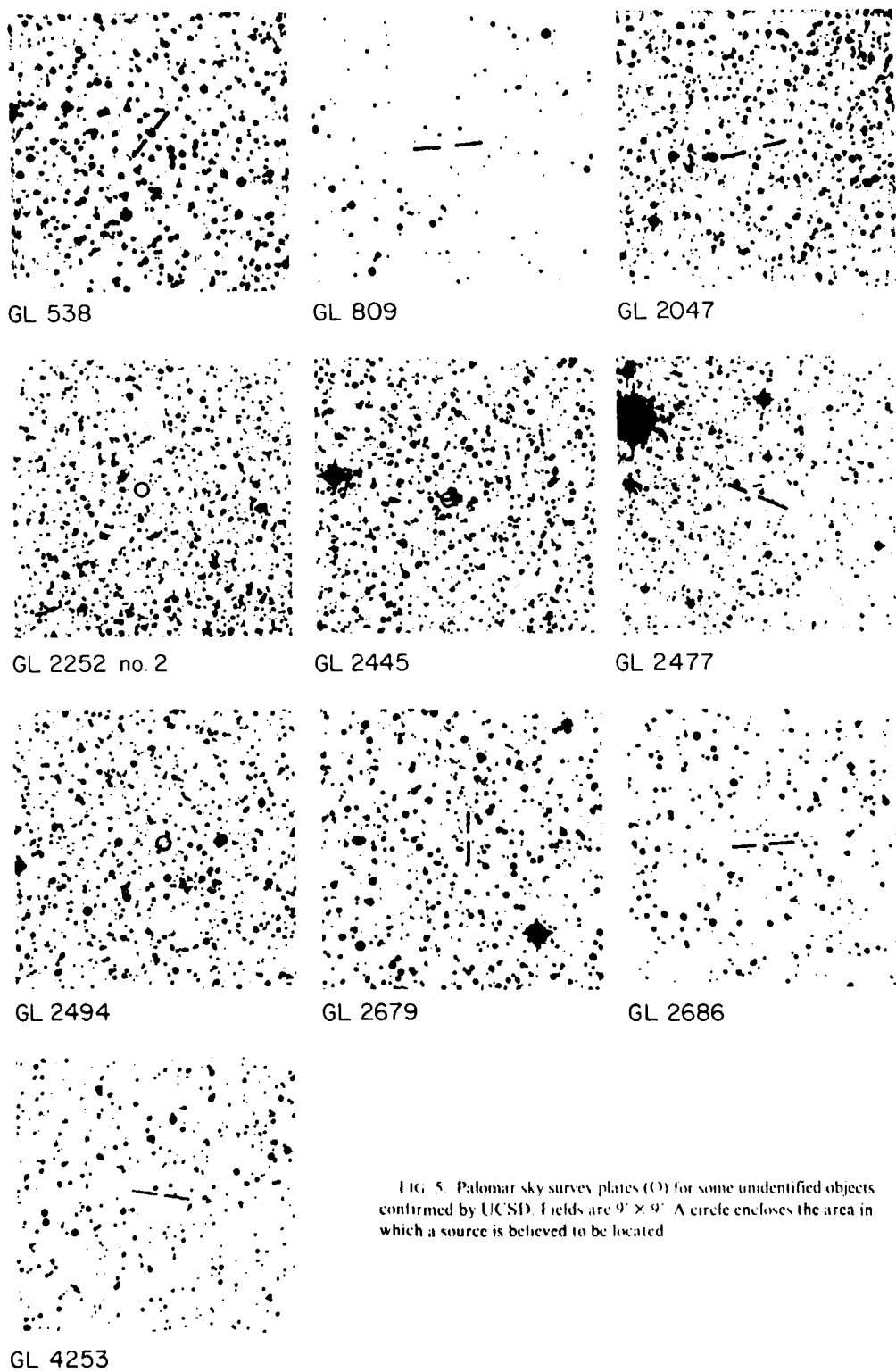


FIG. 5. Palomar sky survey plates (O) for some unidentified objects confirmed by UCSD. Fields are $9' \times 9'$. A circle encloses the area in which a source is believed to be located.

1, 2, etc., in the order of detection during scanning of the error box.

The narrow-band spectrophotometry appears in Figs. 2 and 3. From these data we have made the following tentative classifications: GL 2679 (this work and Cohen and Kuhl 1976) and 2047 are carbon rich; GL 815 and 1131 are probably carbon rich; GL 1074, 1441, 1594, 2009, 2252 No. 1, and 2252 No. 2 are oxygen rich; and GL 873 and 1511 are probably oxygen rich.

Noteworthy objects for which narrow-band spectra have been obtained are GL 2636 and GL 4029. The spectrum of GL 2636 (Fig. 3) possesses the unidentified 3.3- μ m feature discovered by Merrill, Soifer, and Russell (1975) in the planetary nebula NGC 7027. GL 2636 appears to be a multiple source, with both a near- and a far-infrared source in close proximity (30") to a B supergiant (Merrill 1978, private communication). The spectrum in Fig. 3 is of the near-infrared source, which is located 15" W and 15" N of the B supergiant indicated on the finding chart of Fig. 4(a). 1950 coordinates for this object are $\alpha = 20^{\text{h}} 40^{\text{m}} 47^{\text{s}} 0 (\pm 10'')$, $\delta = +42^{\circ} 45' 52'' (\pm 10'')$.

GL 4029 is also a multiple source, where two compact sources have been found within a region of extended infrared emission. The following spectral features have been found in at least one of the sources: in absorption, the 3.1- μ m ice feature, and in emission, the unidentified

3.3-, 6.2-, 7.7-, and 11.2- μ m features. In addition, based on optical spectra obtained at Lick Observatory, the two compact sources are situated on or near two optical objects that appear to be reflection nebulae. The infrared spectra of the compact sources are not presented here due to some remaining confusion in determining to which of the several objects in this region the data pertain. A point between the optical objects is indicated in Fig. 4(b). The 1950 coordinates for one of the infrared sources are $\alpha = 02^{\text{h}} 57^{\text{m}} 32^{\text{s}} 5 (\pm 10'')$, $\delta = +60^{\circ} 17' 22'' (\pm 10'')$. Finding charts for additional objects appear in Fig. 5.

At present, results concerning the statistical nature of the objects in the AFGI catalog would be biased if based on the data presented here. Furthermore, any interpretation of the fraction of multiple sources found so far would be difficult to make since the sources were detected at flux levels below the limits of the AFGI. Future observations, however, are being designed to admit valid statistical conclusions about the AFGI sources.

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 Low, F. J., Kurtz, R. E., Vrba, F. J., and Rieke, G. H. (1976). *Astrophys. J. Lett.* **206**, L153.
 Merrill, K. M., Soifer, B. T., and Russell, R. W. (1975). *Astrophys. J. Lett.* **200**, L37.
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 SAO (1966). "Smithsonian Astrophysical Observatory Star Catalog," Smithsonian Publ. 4652, Vols. I-IV.
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Erratum to "Ground-based Observations of Sources in the AFGL Infrared Sky Survey" by T.R. Gosnell, H.S. Hudson, and R.C. Puetter.

1. Table II contains three minor errors:
AFGL 0873: add the comment NB; 3.5μ mag = 1.73 instead of 11.73.
AFGL 2686: 4.9μ mag = -0.84 instead of 0.84; 11.2μ mag = -3.08 instead of 3.08.
AFGL 3140: identified with SAO 053335, instead of 053355; coordinates $23^h 42^m 10.6^s$, $+41^\circ 46' 52''$.
2. The GL designation is slightly confusing, since the Gliese catalog already uses this indicator (R.S. Harrington, personal communication). We suggest referring to the infrared survey objects by the full prefix AFGL until IAU nomenclature is established.
3. Table II lumps together objects reported in the early AFCRL survey (Walker and Price, 1975) and in the later, improved AFGL survey (Price and Walker, 1976). The following list of 102 objects in Table I appear only in the AFCRL catalog. These have a higher rate of non-confirmation of unidentified sources than do the objects in the current AFGL catalog. Of the sources only in the AFCRL catalog, only three (AFCRL 538, AFCRL 1671, and AFCRL 2474) were "found". These are likely to be accidental discoveries since their magnitudes are fainter than the AFGL detection limits. We list them here only to be able to present our complete data.

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- Price, R.P. and Walker, S.P. (1976), "The AFGL Four-Color Infrared Sky Survey: Catalog of Observations at 4.2, 11.0, 19.8, and 27.4 μ m," AFGL TR-76-0208.
- Walker, S.P., and Price, R.P. (1975), "AFCRL Infrared Sky Survey," AFCRL TR-75-03.

Amendment to Table II
OBJECTS APPEARING IN THE AFCRL CATALOG

105	1180	1507	1645	1729	2022
119	1182	1518	1646	1730	2249
145	1193	1520	1647	1731	2253
538	1194	1522	1649	1735	2265
1005	1197	1524	1655	1737	2277
1006	1290	1528	1657	1738	2298
1011	1297	1529	1662	1739	2438
1013	1305	1530	1664	1742	2441
1015	1373	1573	1665	1795	2457
1019	1375	1574	1667	1802	2470
1029	1377	1577	1668	1808	2474
1031	1382	1578	1671	1812	2478
1032	1383	1580	1672	1813	2489
1046	1384	1582	1674	1815	2638
1048	1385	1587	1723	1884	2669
1049	1390	1590	1725	1897	2944
1054	1391	1644	1727	1901	2954